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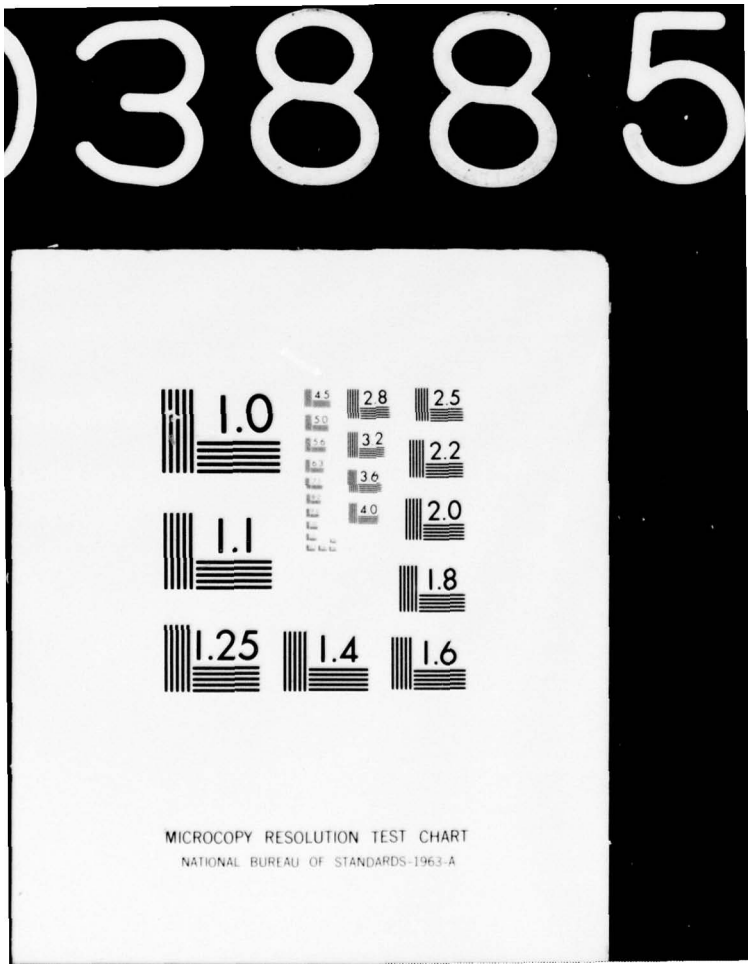
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RADC-TR-76-340, Volume II (of three)
Final Technical Report
March 1977

RASTER IMAGING SOFTWARE
User's Guide

PRC Information Sciences Company

ROME AIR DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
GRIFFISS AIR FORCE BASE, NEW YORK 13441

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Raster Processing
Raster Plotters
Area Symbology
Lineal to Raster Conversion
Type Placement

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Raster Imaging Software was developed to support raster plotting capabilities existing at RADC. The software consists of (1) interactive symbol and text placement capability which operates on the RADC Experimental Compilation Console; and (2) batch processing software to convert lineal data to raster for plotting. Included in the lineal to raster conversion software in addition to creating line weights is the capability to fill areas with a solid fill or pattern fill, to fill between contours of different elevations (elevation

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tints) to perform priority masking, and to generate point symbols and alpha-numerics in raster format.

ABSTRACT

The Raster Imaging Software (RIS) system developed under an RADC contract, enhances the existing Experimental Compilation Console (ECC) and provides raster imaging support to the existing Format Conversion Software (FCS) system. The volume contains the Raster Imaging Software User's Guide. Herein are the operating instructions for the upgraded ECC and FCS systems.

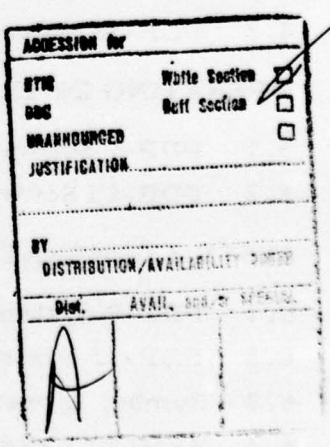


TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

LIST OF FIGURES

LIST OF FIGURES
(Continued)

SECTION I

INTRODUCTION

1.1 BACKGROUND

This document is a final technical report for Contract F30602-74-C-0345 "Raster Imaging Software". An integral part of the above contract required the modification of the existing Experimental Compilation Console/Cartographic Digitizing Plotter (ECC/CDP) and the Format Conversion Software (FCS) systems. The following technical report documents the ECC and FCS capabilities provided under the Raster Image Conversion and earlier contracts as a unified system.

The purpose of the Raster Imaging Software was to combine the ECC/CDP and the FCS systems to provide for point symbol, alphanumeric text, and contour label generation capabilities. The Format Conversion Software was modified to produce plots in areal mode (formation of all line weights by a series of 1 mil spots). Capabilities to perform (1) priority masking of features at intersections, (2) area fill by 1 mil spots, screens, hatchures, or repeated symbology, and (3) fill between two feature classes in which one closed feature is wholly contained within a second closed feature were also added to the FCS system. These modifications have extended the Format Conversion Software to a level where the high quality color separations can be produced on the CBS Graphics Plotter or MBA Scanner/Plotter.

1.2 SYSTEM SUMMARY

The Experimental Compilation Console (ECC) as developed under this effort has furthered the state-of-the-art toward producing a CRT based cartographic work station. It uses a dual computer data

base and software system to support a high precision digitizer/plotter and a dual screen storage tube display station.

The high precision digitizer/plotter maintains the accuracy needed for fine grain feature adjustment while the dual screen CRT allows the operator to select and window his input data at high rate. The CRT system is also supported by a graphic tablet which is presently used to control the graphic cursor on the CRT.

Functionally, the ECC/CDP system provides many of the capabilities required for chart compilation. It has facilities for: (1) offsetting, rotating and scaling on both input and output, (2) inserting, deleting, adjusting, joining of features, and (3) plotting via a plotter or viewing via the CRT system.

The Format Conversion Software accepts the updated feature file from the ECC/CDP system. The FCS system optionally converts data from center line to areal format. The lineal file is then converted to raster and output in either the CBS Graphic Plotter or the MBA Plotter/Scanner format.

The Format Conversion Software is implemented on the HIS-635. The large scale computing capacity of the HIS-635 provides the required mass storage to implement the high speed sort required by the lineal to raster conversion.

1.3 REPORT OUTLINE

This report is organized in eight sections:

- Section I - Introduction
  Presents the background and summary of the Raster Imaging Software.

- Section II - Raster Imaging Software System Flow
- Section III - System Description - ECC/CDP
  Develops the ECC System Description at an operator/user level.
- Section IV - Loading Instructions - ECC/CDP
  Shows how to load and initialize all the ECC software.
- Section V - Operating Instructions - ECC/CDP
  Presents instructions for the operation of all the ECC software, with the exception of the Symbol Library generator.
- Section VI - System Generation - ECC/CDP Batch Programs
  Defines the methods and procedures to be used in generating the ECC software in executable format.
- Section VII - System Description Honeywell 635/645
- Section VIII - Operating Instructions for Format Conversion System

SECTION II

RASTER IMAGING SOFTWARE SYSTEM FLOW

2.1 Total System Flow

The existing system consists of five major processing functions:

- o CDP Input Processes
- o ECC/CDP Compilation Software
- o CDP Output Processes
- o Pseudo-MMS Conversion Process (PSUMMS)
- o Format Conversion Software (FCS) Processes

Figure II-1 illustrates the relationship between these five functions.

2.2 CDP Input Process

The CDP input Process inerprets the MMS feature file and generates two disk files - the CDP file and the PLOT file. The CDP file is the data base used to support the Cartographic Digitizing Plotter (CDP). It contains MMS feature data that may be interactively plotted and updated by the actions of the CDP operator. The PLOT file is the data base used to support the Experimental Compilation Console's (ECC) Tektronix T611B graphics CRT. The CDP Input Process generates the PLOT file by assigning the lineal feature data associated with each 3- by 4-inch sector (window) of the CDP table surface to a reserved area on disk. A 24- by 40-inch area of the CDP table surface is covered by the 8- by 10-inch PLOT file window matrix.

2.3 ECC/CDP Compilation Station

The ECC/CDP Compilation Software is a system that provides interactive support for chart compilation.

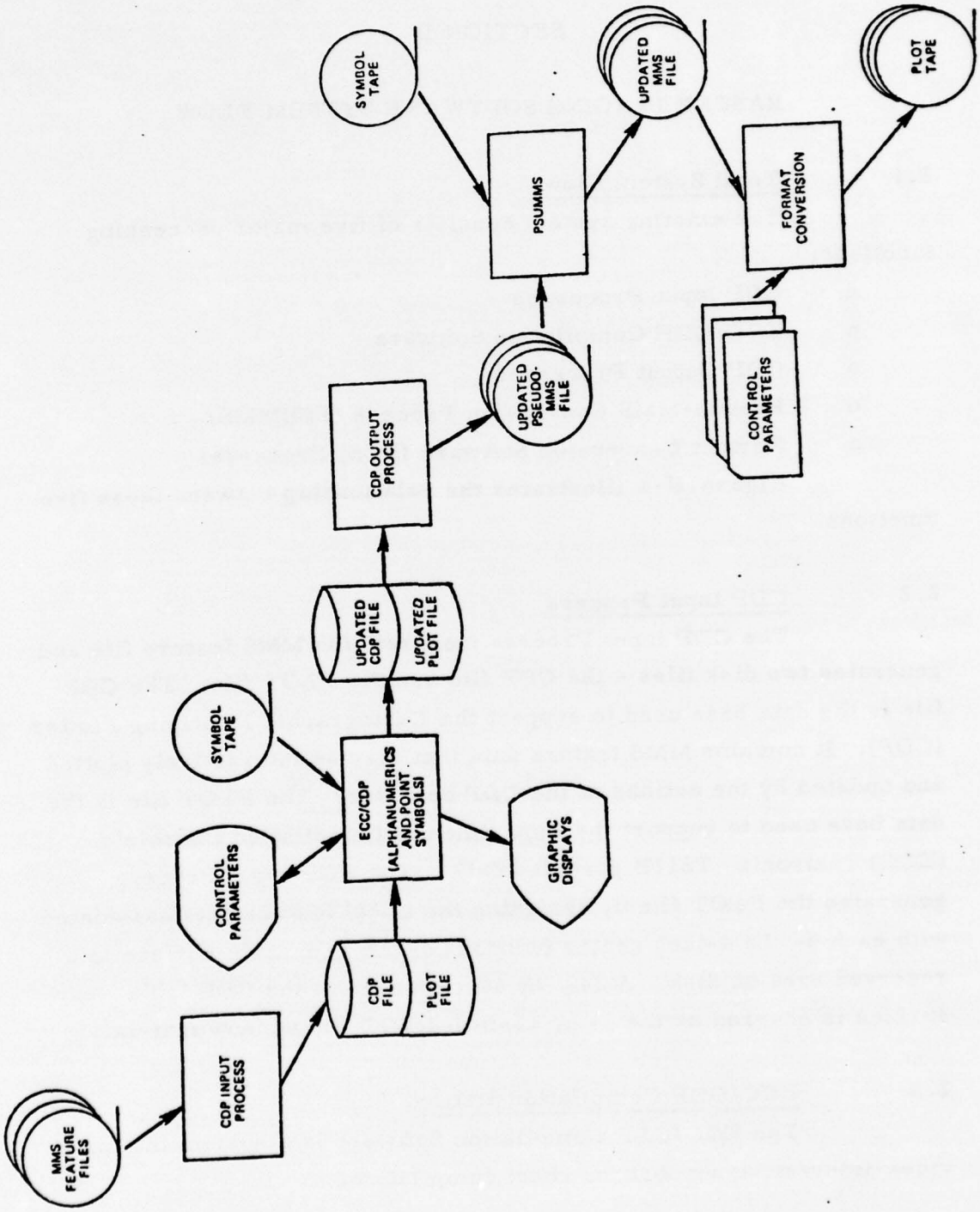


Figure II-1 Present Lineal-to-Raster Image Conversion System

The functions defined under the ECC/CDP systems are divided into two classes, (1) Data Functions, and (2) Compilation. The first class of functions defines the subset of the data base which will be manipulated by the second set of interactive functions. Figure II-2 illustrates the relationship between the above two classes of functions. The Raster Imaging Software effort has been directed toward two specific Compilation functions: (1) Point Symbol and Alphanumeric String Positioning, and (2) Contour Label Positioning. Major modifications have been made to the ECC/PDP-15 software. Figure II-3 illustrates the current modular relationships within the ECC/PDP-15 software. The Lineal to Raster Image Conversion Software Documentation, produced under RADC contract number F30602-73-0086, contains the descriptions of those modules which remained unmodified during this effort.

The Point Symbol or Alphanumeric String Positioning function provides the user with a means of specifying point symbols and alphanumeric strings that are to be added to the MMS feature file. The user defines a Pseudo-MMS record that contains either the point symbol type or the alphanumeric string, type style, and type size via the 4002A CRT. The location and orientation of the point symbol or alphanumeric string is specified by a baseline input via the graphic tablet.

The use of the Pseudo-MMS concept provides the system with a means of defining point symbols with a single MMS record containing the point symbol identification, (x, y) position, and angle of orientation. The Pseudo-MMS record is also used to contain the alphanumeric text data in MMS format.

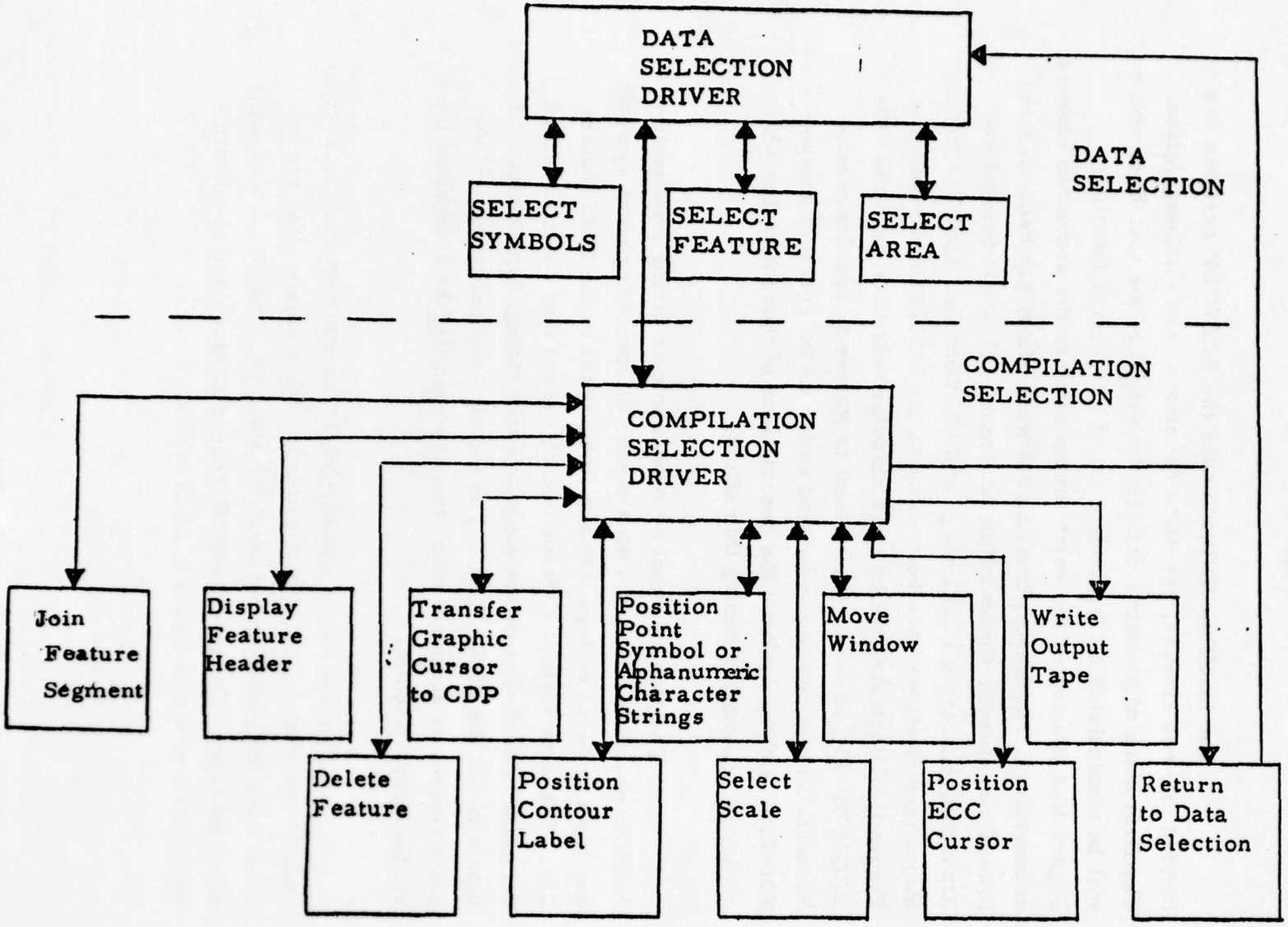


Figure II-2 ECC Software Functional Flow

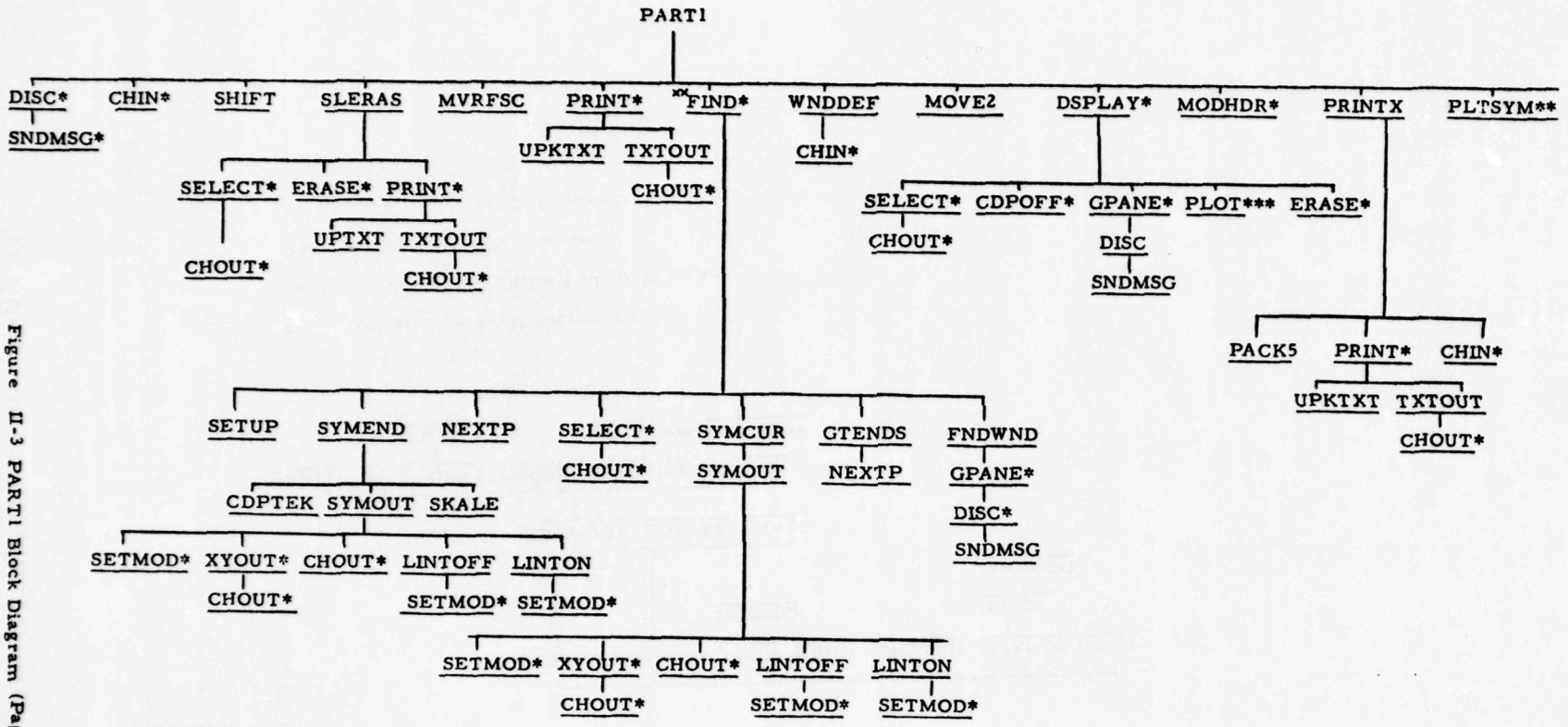


Figure II-3 PART1 Block Diagram (Page 1 of 3)

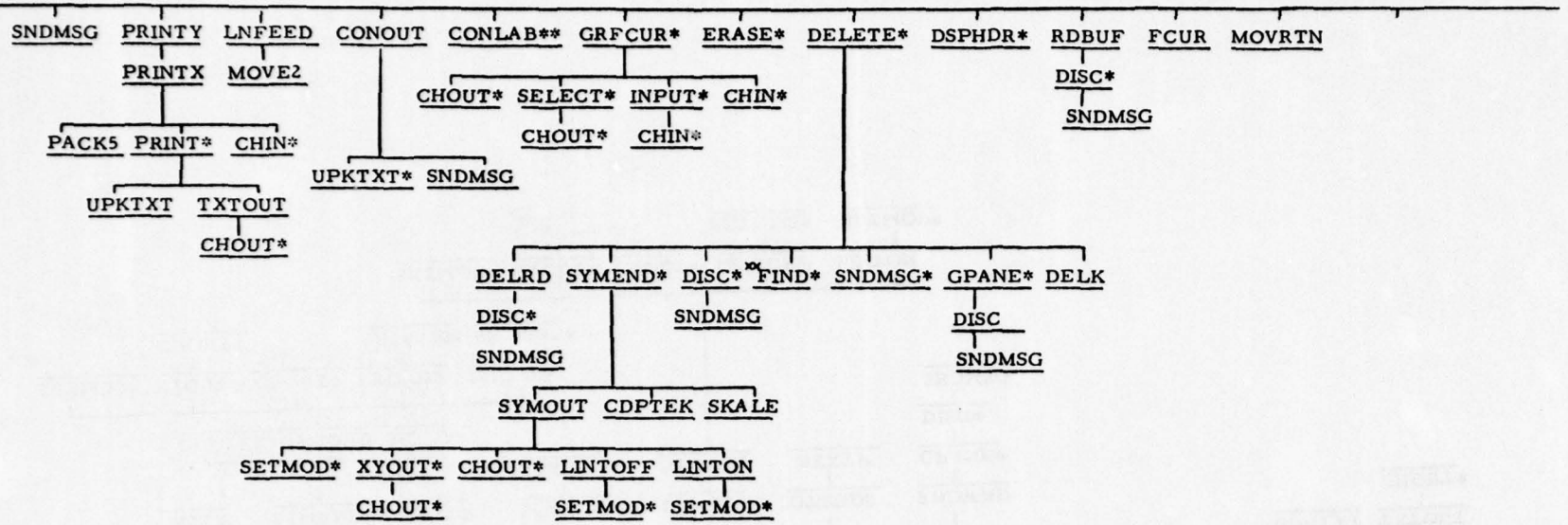


Figure II-3 PART1 Block Diagram (Page 2 of 3)

II-5b

* Indicates External Subroutine

** See PLTSYM/CONLAB Block Diagram

*** See PLOT Block Diagram

** See Subroutine FIND (this diagram)

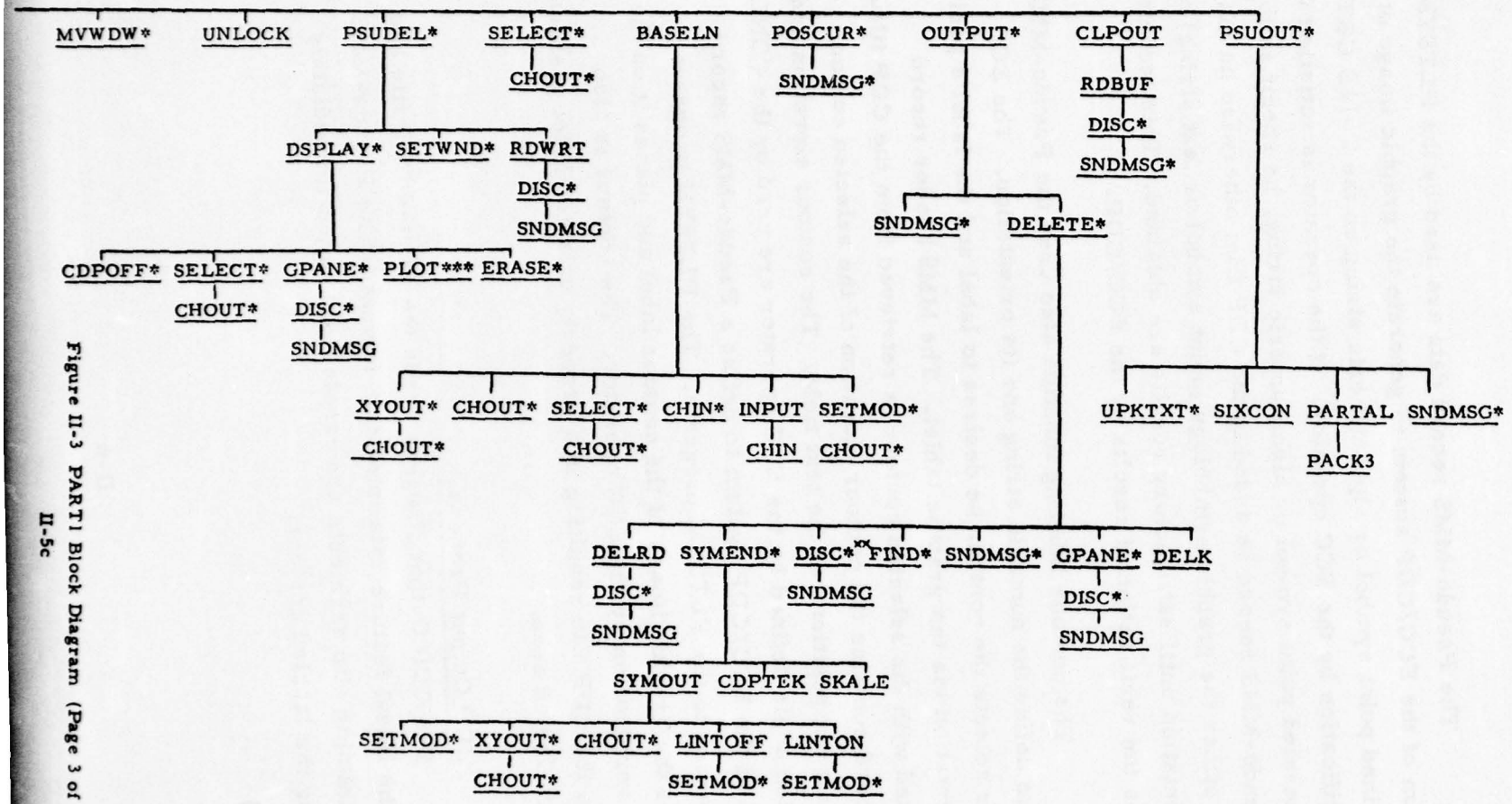


Figure II-3 PART1 Block Diagram (Page 3 of 3)

The Pseudo-MMS record data are used by the PLTSYM program of the ECC/CDP system to generate the graphic image of the defined point symbol or alphanumeric string on the T611B CRT for verification by the ECC operator. If the operator is satisfied with the generated point symbol or alphanumeric string, he specifies that the Pseudo-MMS record be added to the CDP file; otherwise he may change either the graphic symbology (point symbol or text string) or its orientation until satisfactory results are obtained. This technique provides the verification of results by the ECC/CDP.

The contour labeling function also uses the Pseudo-MMS record to define the numeric string and its orientation. The ECC operator selects the contour he desires to label and the label's position and orientation via the graphic tablet. The MMS header record associated with the selected contour is retrieved from the CDP file. This record contains the contour elevation of the selected contour in the first six positions of the text field. The contour elevation and orientation angle defined by the ECC operator are used by the CONLAB program of the ECC/CDP system to define a Pseudo-MMS record that is passed to the PLTSYM program. The PLTSYM program generates the graphic image of the contour label and places it on the CRT for verification by the ECC operator. The contour is also clipped in the CDP file resulting in a properly oriented label positioned within the clipped area.

2.4 CDP Output Process

The CDP Output Process reads the related CDP file and formats the lineal feature data into MMS format. The Pseudo-MMS records defining clip segments are created and output immediately preceeding the labeled contour.

2.5 PSUMMS

Pseudo-MMS records must be converted into MMS records that can be properly interpreted by the Format Conversion Software to produce graphically correct point symbols and alphanumeric text strings. The program PSUMMS reads the MMS tape output by the CDP Output Process and converts each Pseudo-MMS record to one or more MMS records.

The SYMLIB tape, which is used by PSUMMS, contains the point locus of each JOG point symbol casing and each alphanumeric character by type style. Each of these graphic symbols is stored on SYMLIB with an origin at (0, 0) and an angle or orientation of zero. PSUMMS ascertains the point symbol or alphanumeric type style required by a given Pseudo-MMS record and then retrieves the respective casing point loci from the SYMLIB tape. The point loci for an entire point symbol or an entire type style are read to an intermediate disk file to provide speed in retrieving the (x, y) pairs that define each character. PSUMMS generates an MMS record from each point symbol and from each alphanumeric character in a character string.

The MMS tape output by the PSUMMS program may be plotted on the stand-alone CDP system to provide verification of point symbols, alphanumeric text strings, and contour label positions.

2.6 Format Conversion

The Format Conversion Software (FCS) is the final step in the raster image conversion system. The primary task of FCS is the conversion of the lineal MMS data to a raster format capable of driving either the Graphics Plotter or the Scanner/Plotter. While the Format Conversion Software also accepts raster data as input,

the Raster Imaging Software effort is not concerned with the FCS raster input facility.

The initial version of FCS converted lineal MMS input to centerline raster output. Varying line widths were plotted by altering the dot size of the Graphics Plotter.

The most current version of FCS, produced under the Raster Imaging Software effort, included a number of additional functions to the original FSC. These functions includes (1) conversion of center-line data to areal mode, (2) area fill of closed feature types, (3) fill between two feature classes where one closed feature is self-contained within the other, (4) priority masking of intersection feature classes, (5) area fills with screen and hatchures, and (6) area fills with repeated symbology.

The new FCS is capable of extracting features from an MMS input file based on the R, F, S, C, and T (first six characters) fields. Varying output densities for plotting on the Graphics Plotter are also selectable.

Programs to support the Scanner Plotter are contained in the updated FSC. These programs are untested since the Scanner Plotter is not yet in operation at the ECF.

The FCS area fill function is the primary function used in producing the graphic plots of the point symbols, alphanumeric text, and contour labels. MMS records output by the PSUMMS describe casings for each of the above types of graphic symbology. These closed casings must be filled by a dot matrix to produce cartographically acceptable symbols. These dot matrices are produced by the

area fill function. Particular attention has been given to accuracy of the area fill algorithm during the test and evaluation of the Raster Imaging Software programs. The flow chart of the system flow through the Format Conversion System is Figure II-4. The block diagram of the various modules and what programs and subprograms are called by these modules is included in Figure II-5.

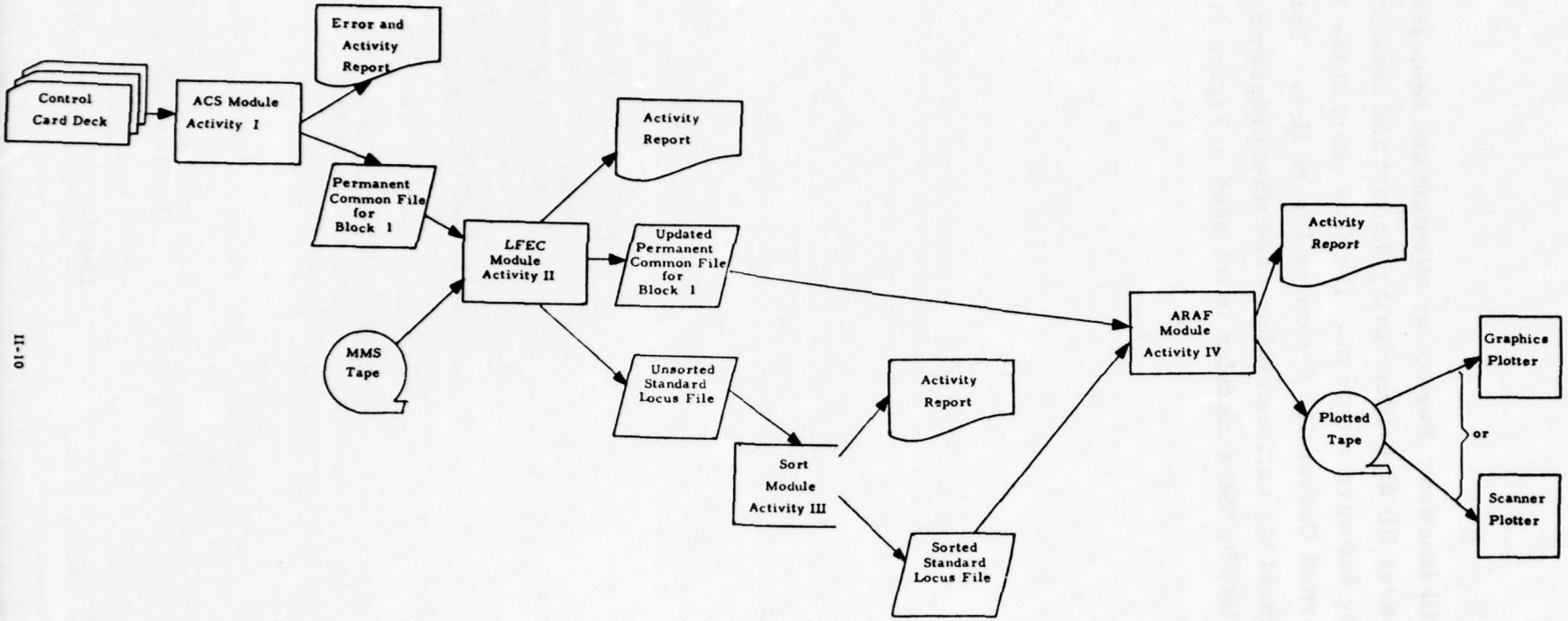
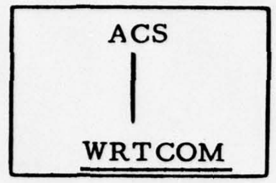


Figure II-4 Format Conversion System Flow Chart



Note: This job is composed of four activities:

1. ACS Module
2. LFEC Module
3. SORT Module
4. ARAF Module

The SORT Module is a system routine and does not call any subprograms.

Figure II-5 ACS Module (Page 1 of 3)

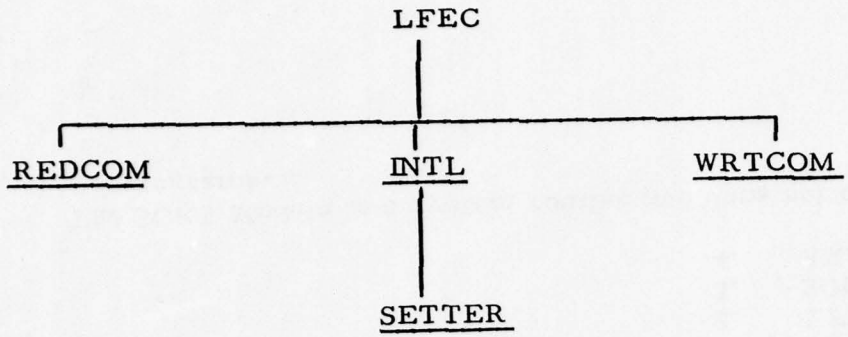


Figure II-5 LFEC Module (Page 2 of 3)

Note: This job is composed of four activities:

1. ACS Module
2. LFEC Module
3. SORT Module
4. ARAF Module

The SORT Module is a system routine and does not call any subprograms.

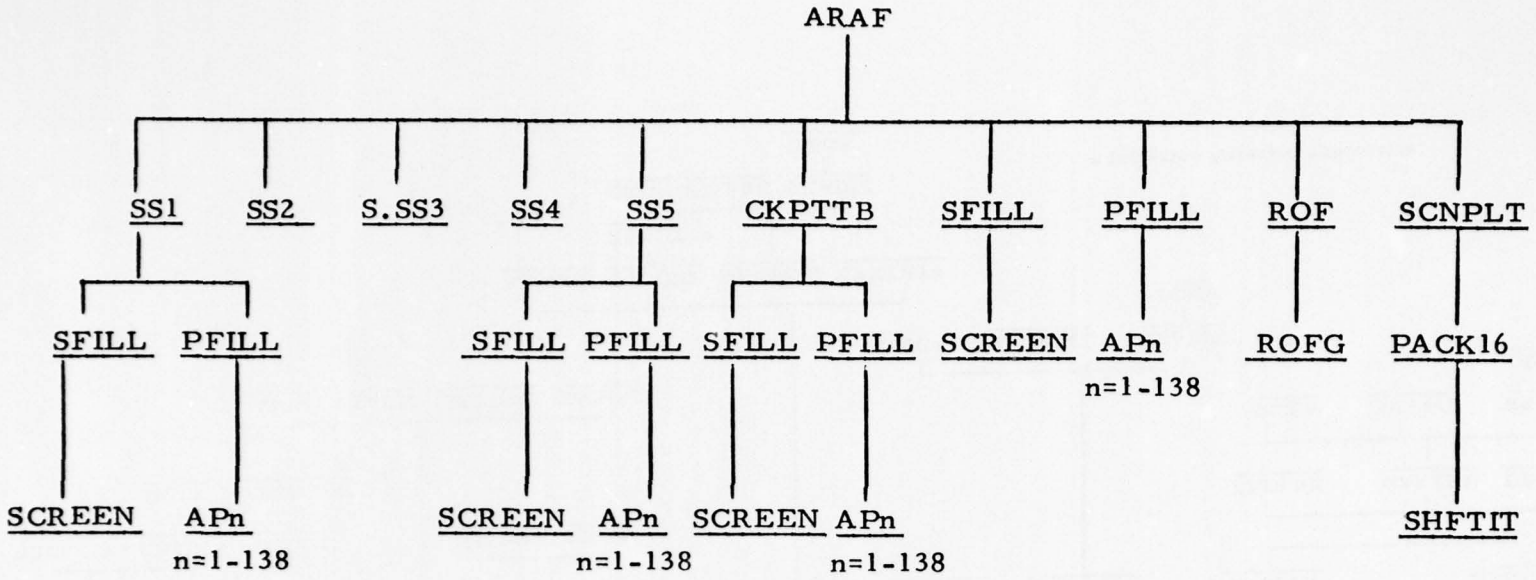


Figure II-5 ARAF Module (Page 3 of 3)

Note: This job is composed of four activities:

1. ACS Module
2. LFEC Module
3. SORT Module
4. ARAF Module

The SORT Module is a system routine and does not call any subprograms.

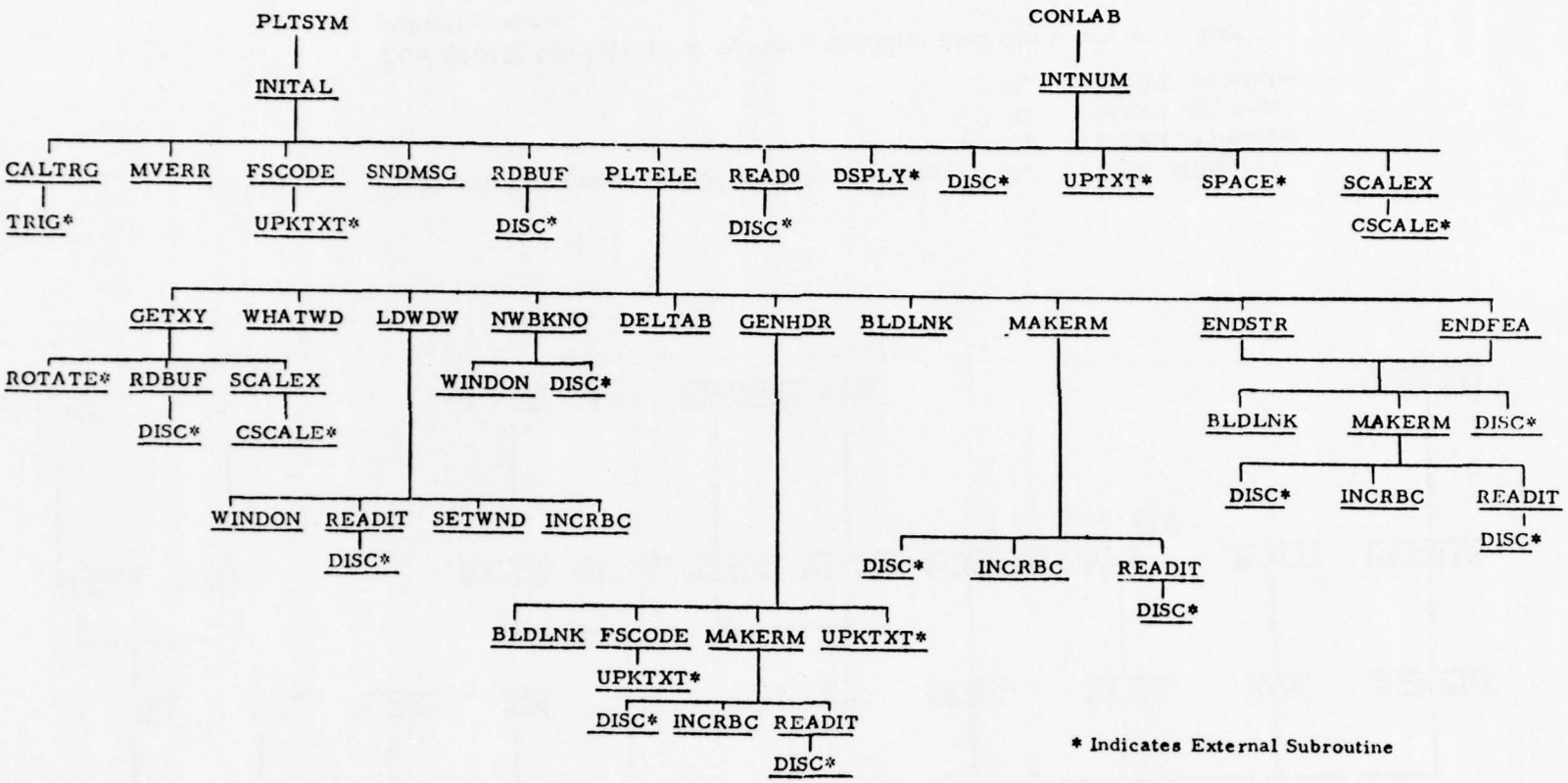


Figure II-6 PLTSYM Block Diagram

SECTION III

SYSTEM DESCRIPTION

3.1 GENERAL

The "Experimental Compilation Console" (ECC) is a dual computer hardware/software system composed of the existing PDP-9/CDP and a PDP-15/CRT system developed earlier by RADC. A complete description of the CDP and its functions is available in earlier RADC Technical Reports. This report describes the non-CDP functions which were developed to implement the ECC.

Figure III-1 shows the hardware components of the ECC system.

3.2 HARDWARE

Figure III-2 is a block diagram of the ECC. It is composed of two major subsystems: (1) the PDP-15 with CRT's and Graphic Tablet, and (2) the PDP-9 with its peripherals and the Cartographic Digitizing Plotter (CDP). The two subsystems communicate via the Inter-Computer Control Unit (ICCU) and use the PDP-9 Discs as common data storage.

3.2.1 PDP-9 System

Table III-1 shows the elements of the ECC PDP-9 hardware system. It is composed of an expanded PDP-9 computer and the Concord Control "Cartographic Digitizing Plotter" (CDP).

The computer is a DEC PDP-9 with a 32K memory operating under the DEC keyboard monitor (V4E or DOS).

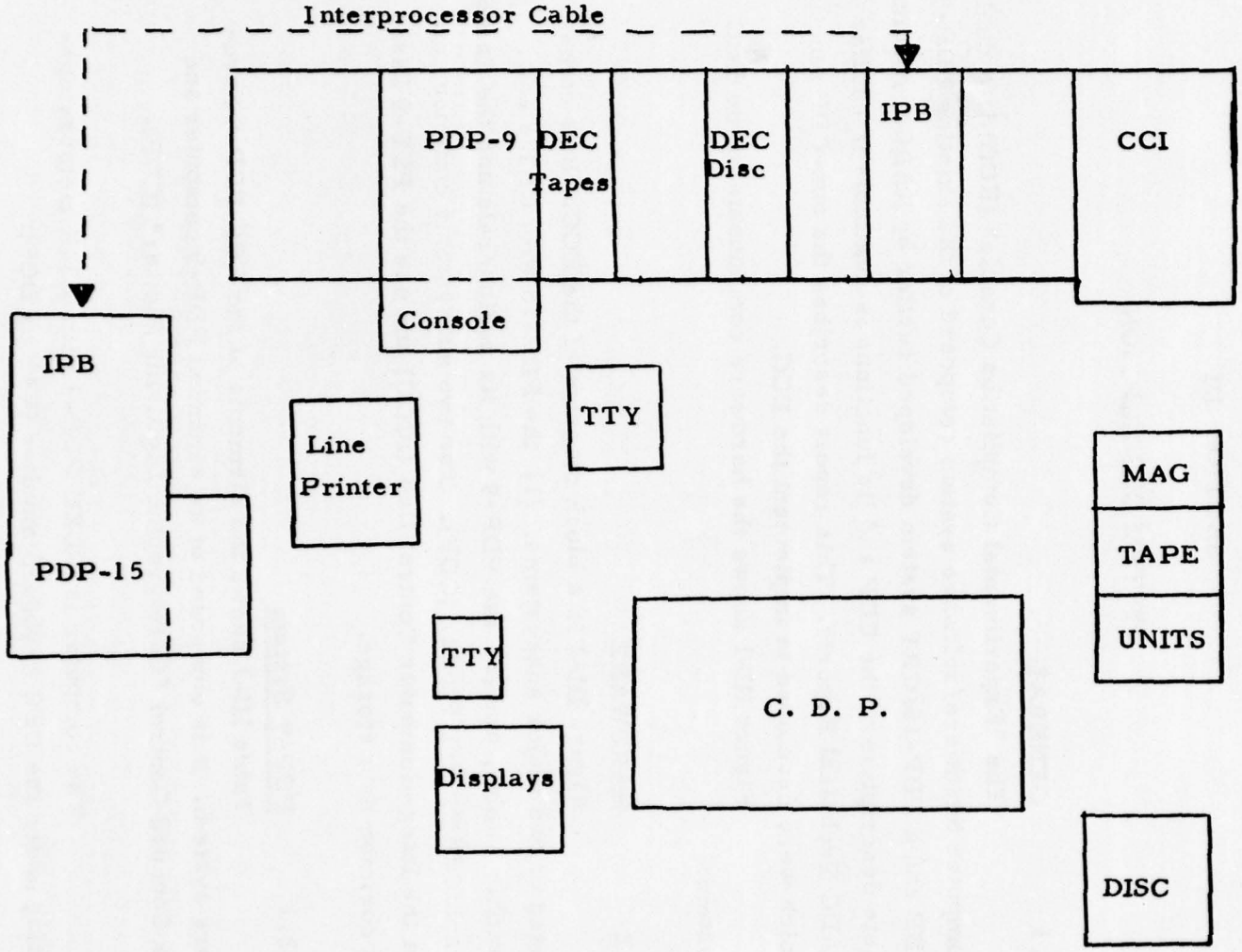


Figure III-1 - ECC Hardware Components

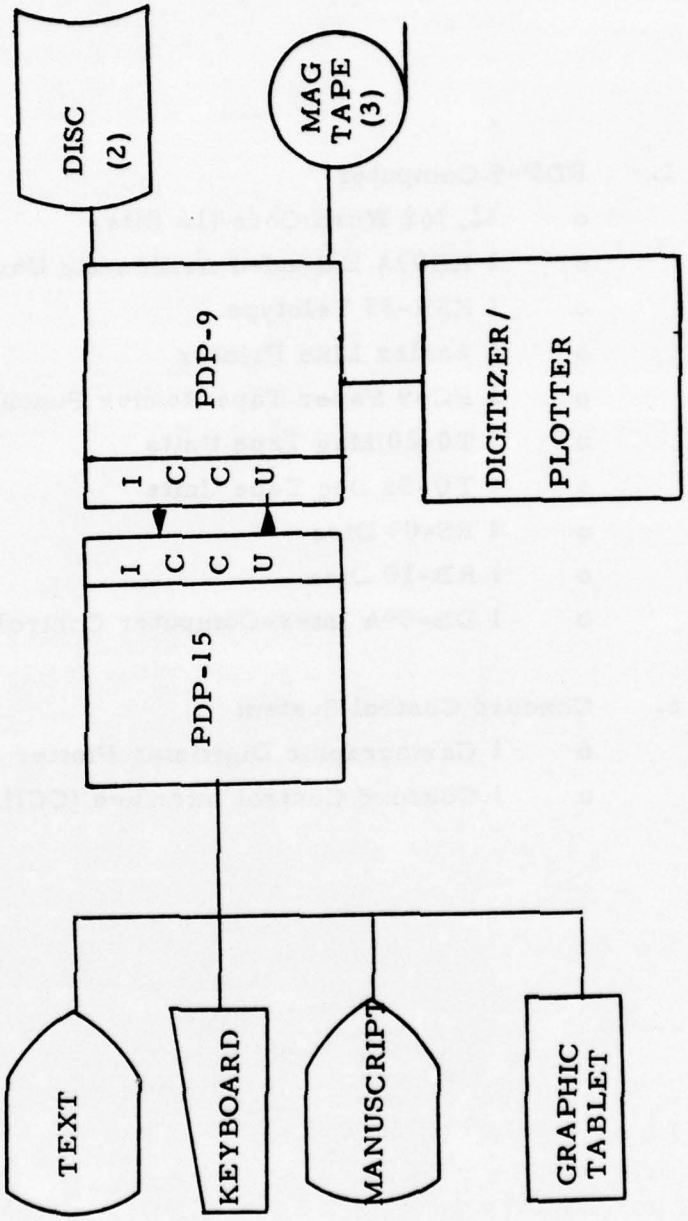


Figure III-2 - Experimental Compilation Console Hardware

1. PDP-9 Computer
   - o 32,768 Word Core (18 Bits)
   - o 1 KE09A Extended Arithmetic Unit
   - o 1 KSR-33 Teletype
   - o 1 Analex Line Printer
   - o 1 PC-9 Paper Tape Reader Punch
   - o 3 T0-20 Mag Tape Units
   - o 4 TU-55 Dec Tape Units
   - o 4 RS-09 Disc
   - o 1 RB-10 Disc
   - o 1 DB-09A Inter-Computer Control Unit

2. Concord Control System
   - o 1 Cartographic Digitizing Plotter (CDP)
   - o 1 Concord Control Interface (CCI)

Table III-1 - PDP-9 Subsystem Hardware Components

The CDP is a relatively slow but very accurate digitizer/ plotter with a resolution of 1 Mil and repeatability of ±1 Mils.

Under the ECC concept the PDP-9/CDP is mainly supportive. The major ECC functions are supported by the CRTs while the CDP is used only for joining and editing features.

3.2.2 PDP-15 Subsystem

Table III-2 shows the hardware elements of the PDP-15 portion of the ECC. It is composed of a DEC PDP-15/20 Computer and a Tektronix Display System.

The computer is a standard DEC PDP-15/20 with a 32K core using the keyboard monitor operating system "KMS-V5B".

The Tektronix display system is based on, a T-4002A Storage Tube with keyboard used as a textual display, a T-611 Storage Tube used for displaying the lineal feature data, and a CM-119 Graphic Tablet used for manipulating a graphic cursor on the graphic display (T-611).

In operation a textual display defining the functions implementing the ECC is presented on the T-4002A while the chart data being operated on is displayed on the graphic tube.

3.3 SOFTWARE

Figure III-3 shows the basic functions supported by the ECC. They are composed of two sets of software modules running in the dual computer system and are supported by a data base held on the PDP-9 Disc.

1. PDP-15/20 Computer
   - o 32,768 Word Core (18 Bits)
   - o 1 KE 15 Extended Arithmetic Unit
   - o 1 KSR-35 Teletype
   - o 1 PC-15 High Speed Paper Tape Reader/Punch
   - o 1 TC-15 DEC Tape Controller
   - o 2 TV-56 Dual DEC Tape Transport
   - o 1 DB-09A Inter-Computer Control Unit

2. Tektronix Display System
   - o 1 T-4002A Graphic Computer Terminal
   - o 1 T-940M Display Multiplexer
   - o 1 T-611 Storage Display Unit
   - o 1 CM-119 Graphic Tablet

Table III-2 - PDP-15 Subsystem Hardware Components

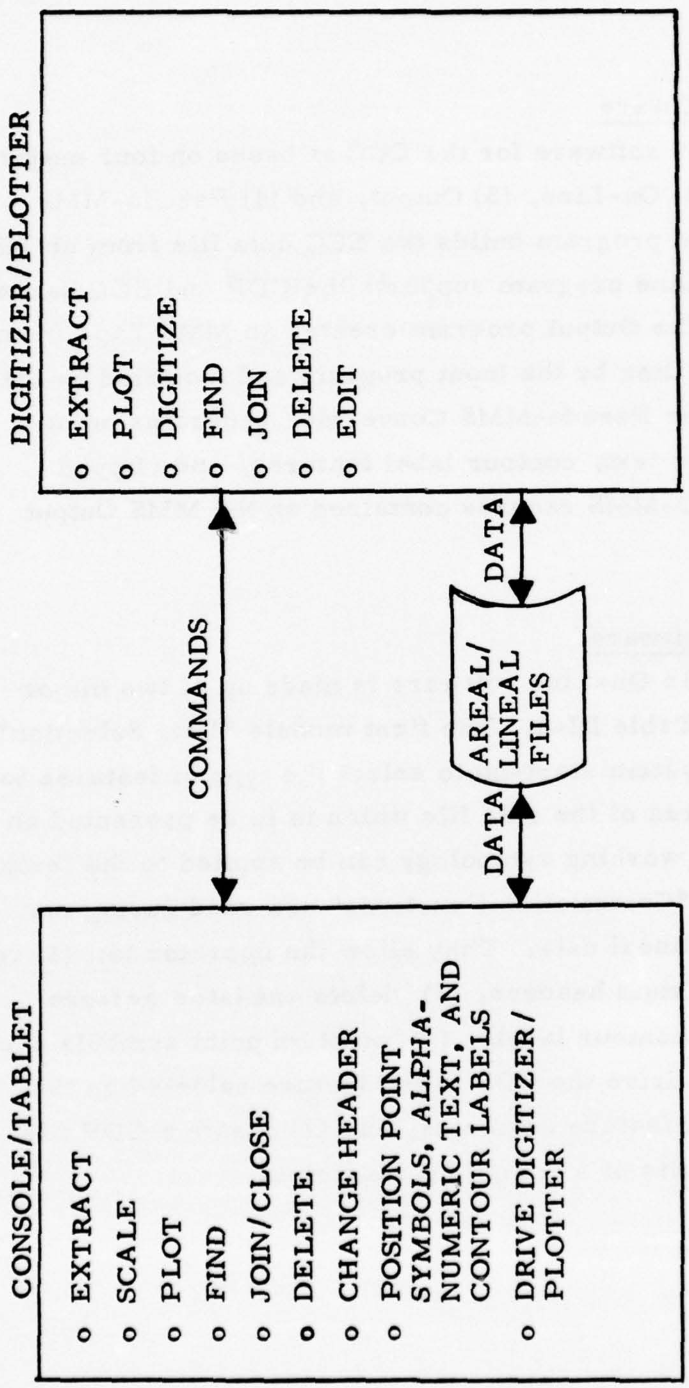


Figure III-3 Experimental Compilation Console Cartographic Functions

3.3.1 PDP-9 Software

The PDP-9 software for the ECC is based on four major modules: (1) Input, (2) On-Line, (3) Output, and (4) Pseudo-MMS Conversion. The Input program builds the ECC data file from an MMS Input Tape. The On-Line program supports the CDP and ECC hardware/ software functions. The Output program creates an MMS Tape from the data stored on the Disc by the Input program and modified by the On-Line program. The Pseudo-MMS Conversion generates point symbols, alphanumeric text, contour label features, and clipped features from PSEUDO-MMS records contained on the MMS Output tape.

3.3.2 PDP-15 Software

The PDP-15 On-Line software is made up of two major modules as showin in Table III-3. The first module "Data Selection" is used primarily at system start-up to select the type of features to be displayed and the area of the data file which is to be presented on the CRT. In addition, working symbology can be applied to the features being displayed. The "Compilation Functions" are used during the review and edit of the lineal data. They allow the operator to: (1) review and change the MMS textual headers, (2) delete and later restore features, (3) position contour labels, (4) position point symbols and alphanumeric text, (5) drive the CDP to the feature selected on the CRT, (6) perform join feature segments, and (7) create a CDP file which contains the results of a compilation session.

1. Data Selection
   - o Select Feature Class to be Displayed
   - o Select Area to be Displayed
   - o Symbolize Features
   - o Proceed to Compilation Function

2. Compilation Functions
   - o Display Header
   - o Delete Feature
   - o Position Contour Labels
   - o Position Points Symbols and Alphanumeric Text
   - o Transfer Graphic Cursor to CDP
   - o Join Feature Segments
   - o Select Scale
   - o Move Window
   - o Position Graphic Cursor
   - o Return to Data Selection
   - o Write Output Tape

Table III-3 - ECC PDP-15 Software

SECTION IV

LOADING INSTRUCTIONS

4.1 PDP-9 SYSTEM LOADING

The PDP-9 CDP/ECC System is contained on two system DECtapes. The first tape, labeled "CDP/ECC SYSTEM", contains the V4E monitor system, the Input Processor, and the Output Processor routines. The second DECtape labeled "CDP/ECC ONLINE" contains the on-line operating system as a core image on the "Q" area. Both tapes are necessary to load and operate the CDP/ECC System software.

4.1.1 System Set Up

A cold start is not required, in general, when the CDP/ECC system has been operating. The V4E monitor can be obtained by a boot-strap or restart. See Paragraph 4.1.3, p. IV-2.

At this time both DECtapes should be mounted on the DEC tape drives, write lock, remote. The "CDP/ECC SYSTEM" DECtape No. 602 should be set to unit number 8 (logical unit 0). This assignment is mandatory if a "cold start" is to be performed. The "CDP/ECC ONLINE" DECtape No. 503A should be set to unit 4, write lock, remote. The cartographic 32-word MMS Formatted magtape to be processed should be mounted on a tape drive and set to unit 1, remote, no ring (write lock).

4.1.2 Cold Start for CDP/ECC System

If the CDP/ECC operating system is resident on Burroughs Disc 0, the cold start is unnecessary, and the procedure beginning in Section 4.1.3 may be followed. The operating system is present

when the response to control (↑) C (hit simultaneously) is MONITOR V4E.

For a "cold" start the contents on the "CDP/ECC System" must be transferred to Disc unit 0. This transfer is accomplished by using the standard DSKSAV routine. The DSKSAV program is supplied as a paper tape and the operating procedure is as follows:

a. Place the DSKSAV paper tape in the paper tape reader.
b. Set the Address switches as indicated on the tape. (77720)
c. Press STOP, I/O, RESET and then READIN.

When loaded, DSKSAV types "DSKSAV Vnn" at which time all Accumulator switches must be set to 0. Now press the CONTINUE switch and the transfer from DECtape to Disc 0 will begin. The CDP system now resides on Disc unit 0, and the ECC functions must be loaded. The third accumulator switch from the right must now be set to one so that a 4 is indicated. Press the CONTINUE switch and DECtape No. 503A will be transferred to Disc 0.

4.1.3 CDP/ECC System Boot Strap Loader

The V4E system monitor is used for loading and executing the CDP/ECC programs. Control may be given to the V4E Monitor using the following methods. After a cold start or when another operating system is in control, the V4E paper tape bootstrap must be used. If V4E is already core resident simply strike a control C (↑C) on the teletype. When the ↑C option is used, be certain the ECC/CDP operating system is on Disc 0. If uncertain, treat as if a cold start is required. See Section 4.1.1.

Operation of the bootstrap is as follows:

a. Place "Disk Boot V4E Burroughs Disc" paper tape in the paper tape reader.
b. Set the Address switches as indicated on the paper tape (77637)
c. Press STOP, I/O, RESET and then READIN.

In either case, bootstrap or Control C, the monitor will respond with Monitor V4E. To restart the CDP system under V4E, set the switches to the restart address (77646) and press I/O RESET and START.

4.1.4 PIP Copy

The Peripheral Interchange Program (PIP) is a standard program which allows data to be transferred from one device to another. Since this program is extremely useful, it will be described here. To copy from DECtape N to Disc M use the following procedure:

a. The monitor has typed a $, you respond with PIP (↵ = carriage return)
b. PIP will identify itself with PIP Vnn
c. You respond with C DKM (H) ←DTN ↵

The contents of DECtape on unit N will now be copied to Disc M. When the transfer is complete, a > will be retyped by PIP, at this time the system tapes are on Disc and everything is ready to run. Return to the monitor at any time by typing a Control C (↑C).

4.2 PDP-15 SOFTWARE

The PDP-15 software for the ECC is contained in two tapes. One holding the DEC KMS9-15 V5B Monitor and the other holding the ECC source code with a binary core image in the "Q" area (F1). This section of the users' manual describes the loading procedure for both of these tapes.

4.2.1 KMS9-15 V5B Advanced Monitor

Mount the Monitor DECtape and set it to logical unit "0" remote, write lock. Place the paper tape bootstrap in the reader, set the address switches as given on the tape (77637) then press "RESET" followed by "READIN".

When the monitor has been loaded it will type out as follows:

KMS9-15␣V5B↵

4.2.2 ECC Application

Mount the ECC tape (F1) on DEC unit 1, remote, write lock. Type "↑C" to call the monitor, when the monitor types out "KMS-V5b" proceed to the Textronix 4002A CRT. Push the button labeled REMOTE/LOCAL so that the REMOTE portion is down. Depress the ERASE key followed by the HOME key to clear the display. Type in G△1 to read in the "Q" area from tape F1 on DECtape unit 1. Once the tape has stopped moving, type "↑S" to start the ECC program. At this point ready the T611B by turning the on/off switch beneath the screen to "on" and pushing the ERASE button when the screen glows bright green.

NOTE: Be sure CDP/ECC ONLINE System is running on the PDP-9 before proceeding.

SECTION V

OPERATING INSTRUCTIONS

5.1 PDP-9 SOFTWARE INITIALIZATION

The CDP/ECC System software is comprised of four basic stand-alone PDP-9 programs. The input processor reads in a 32-word MMS Formatted data tape and builds two data files, the standard CDP file on the Burroughs Disc and an ECC Plot file on the DEC Disc. The CDP/ECC On-Line program allows the man/machine interaction which manipulates and changes the data files. The Output processor processes the updated data file and produces a new 32-word MMS Formatted Data tape. The Pseudo-MMS Conversion Programs translates encoded point symbols, alphanumeric strings, and contour labels into 32-word MMS Formatted Data records. The Output processor builds Pseudo-MMS records which define these symbols in a condensed 32-word MMS structure. Each point symbol, alphanumeric string contour label, or clipped feature is defined by a single Pseudo-MMS header followed by a single Pseudo-MMS data record, or several data records for clipped features. These Pseudo records must be expanded to digitally represent the symbol or string as a feature in 32-word MMS Formatted Data Tape.

A more complete discussion of the functional operation of the input processor, the CDP portion of the CDP/ECC On-Line program, and the Output processor can be acquired from RADC operational publication on the predecessor CDP system.

5.1.1 Input Processor Initialization

The Input processor is in core image format, resident on the system Disc 0. (See Section 4.1). Using the monitor GET command,

the Input processor may be transferred to the PDP-9 core and program control relinquished to it. The following procedure will initialize the Input processor:

a. In response to the monitor $, Type
   G␣0↵ (↵ , carriage return)
b. Wait about 3 seconds and type
   ↑S (CNTL Key and S)
c. The Input processor will identify itself and ask for parameters.

The teletype request for parameter information is self explanatory. However, for variations on the uses of the parameter, and their functions the CDP manual should be consulted.

Once all parameter requests have been satisfied, the Input processor will begin reading the magnetic tape unit 1. When the tape has been processed, the number of features read from the tape will be printed on the teletype and the tape rewound. The Disc block and word count will also be printed, save this information for the On-line routine. Program control will be returned to monitor. Remove 32 word MMS input tape from magnetic tape unit 1.

5.1.2 CDP/ECC On-Line Initialization

The CDP/ECC ONLINE programs are in the "Q" area of Disc 4 as a core image file. Like the Input processor, the monitor GET command may be used to bring in the on-line software. Use the following procedure to initialize the CDP/ECC ONLINE program.

a. On the CCI (see Figure III-1, p. III-2) push the buttons POWER ON then SERVO ON. The OFF-LINE light will remain lit until the unit is on-line.

b. In response to the monitor $, type G␣4↵

c. Wait about 3 seconds and then type ↑S

d. Type in block and word from Input Processor with leading zeroes as required.

↑PWRITES␣BBBBB␣WWWWW↵

e. Now to set origin, be sure CDP stylus is in lower left corner, then type ↑PO↵

f. Now set the tool and offset in the form N␣± XXXXX ± YYYYY where N-Tool Front or Back; example of front tool follows.
↑PNTOOLF 00054-10145↵. This is noted on teletype paper stand.

g. Proceed to the CDP. Move the stylus so that the crosshairs are aligned with the registration mark in the lower left corner of the table. When the stylus is in a lock position, it can be moved by depressing the button with no cover to the right of the line button on the CDP keyboard. After the stylus has been aligned, press on-line button on the CDP station keyboard.

h. Press FIND 0. on CDP station keyboard, after stylus moves to 0 position, press FIND 0. again.

i. Mount the symbol library tape, SYMLIB, on magnetic tape unit 1, write lock, remote.

The CDP/ECC System is now running. Consult the CDP system manual for the functions available with this system.

5.1.3 Output Processor Initialization

The Output Processor reformats the updated CDP file into a 32-word MMS format tape. After making changes from the ECC it is necessary to call WRAPUP (See Write Output Tape, Section 5.2.2.11) to perform the CDP file updates prior to initializing the Output processor in order to update the CDP file with edits made during the ECC run.

A scratch tape with the write ring in place should be mounted on a magnetic tape drive set to unit No. 1 on-line. This unit will receive the 32-word MMS data generated by the Output Processor.

The Output processor is located on the system Disc 0 as an execute file. Therefore, it is only necessary to tell the monitor to execute the Output processor. The following command via the teletype will load and initialize the output software:

a. In response to the monitor $, type
   E␣OUTPUT
b. The Output Processor will identify and ask for parameters.

5.1.4 Pseudo-MMS Conversion (PSUMMS)

The Pseudo-MMS Conversion routine (PSUMMS) generates feature data from Pseudo-MMS records created during execution of the ECC. These records, when they exist, are contained in the MMS Output tape generated by the Output Processor (See Section 5.1.3). Pseudo-MMS records will exist only if either contour labels, point symbols, or alphanumeric strings have been created (See Sections 5.2.2.3 and 5.2.2.4) during ECC execution. Therefore, the execution of the PSUMMS routine should be omitted where no contour labels,

point symbols, or alphanumeric strings have been added to the digitized feature data during the previous ECC run.

The PSUMMS execution module is contained on the PSUMMS DECtape No. 611. This program is executed under the Disc Operating System (DOS). To load DOS begin at (a), to reinstate DOS begin at (d) below:

a. Mount DECtape labeled DOS 1 of 2 on unit 1, remote, write lock.

b. Boostrap the system: Place DOSSAV paper tape in the paper tape reader, set the address as indicated (37720), press STOP, I/O RESET, and READIN.

c.

Response will be:	Operator Response:
DOSSAV	
INPUT DEVICE?	DT↵
UNIT No.?	1↵
OUTPUT DEVICE?	DK↵

This initiates the copy of the DOS system from DECtape unit 1 to Disc 0. When the tape has been transferred, response is TAPE DONE, MOUNT ANOTHER. Remove the DECtape DOS 1 of 2 and mount DOS 2 of 2 on unit 1, remote, write lock. Hit 2 carriage returns on the TTY. When the transfer is complete, response will be INPUT DEVICE?

d. Place the DOS BOOT paper tape in the paper tape reader, set the address as indicated (77637), press STOP, I/O RESET, and READIN. Response will be: DOS-15 V1A

$

The PSUMMS routine searches the 32-word MMS Format Tape output by the Output Processor for Pseudo-MMS records processing each as it is encountered, while copying all non-Pseudo-MMS records to the Final Output Tape.

PSUMMS requires three magtapes during its execution. These must be mounted as follows:

a. MMS Output Tape (i.e., output tape generated by the Output Processor) is mounted on magtape unit No. 1.

b. A scratch tape with the write ring in position is mounted on unit No. 2 to receive the Final Output tape.

c. SYMLIB tape (symbol library tape) is mounted on magtape unit No. 3.

PSUMMS is initialized by assigning the required magtapes to their logical device numbers and accessing the PSUMMS module and relinquishing control to it. This is accomplished by the following monitor commands.

a. After bootstrapping the DOS system (or ↑C in DOS) the monitor will respond with $. Assign DECtape containing PSUMMS by typing A △ DT0 △ -14↵.

b. Mount the PSUMMS DECtape (No. 611) on unit 8 (logical unit 0), remote, write lock.

c. Teletype response is again $. Begin execution of PSUMMS by typing G △ PSUMSL BIN↵. When the DECtape stops, type ↑S and the program will begin.

d. The program is complete when all three magnetic tapes have rewound to load point and the console lights indicate no activity. At this point ↑C yields no response.

e. To restart the system, re-boot the appropriate paper tape or set the address switches to the restart address (77646) and press I/O RESET, START. Response is DOS-15 V1A.

The Pseudo-MMS records contain the definitions of point symbols, alphanumeric text, and contour labels in an encoded form. As each Pseudo-MMS record is encountered, PSUMMS (1) determines the symbol to be generated, (2) reads the specified point locus from

the symbol library tape, (3) rotates and translates each point to its specified orientation and position, and (4) generates feature data in 32-word MMS Format. The generated feature is then output to the Final Output Tape. The Pseudo-MMS records may also contain data defining clip feature segments. Upon locating the proper feature, one or more features are created, deleting the clip segments. PSUMMS does not access the symbol library tape for this process.

Upon termination magtape unit No. 2 will contain an MMS tape with point symbols, alphanumeric text, contour labels and clipped contours defined as cartographic feature data in 32-word MMS Format.

5.2 PDP-15 SOFTWARE

The ECC software (Figure V-1) is composed of two time phased software sets: (1) Data Selection, and (2) Compilation. During the Data Selection phase the operator is required to identify those features he wants displayed, what area of the map the display is to cover, and whether symbols are to be on or off. In the Compilation phase the operator manipulates the data specified by the Data Selection process by modifying its header; deleting complete features; specifying contour labels, point symbols and alphanumeric text; joining feature segments; and transferring data to the CDP for the Edit Function.

5.2.1 Data Selection

Once the ECC program has been loaded into the PDP-15 core and the CDP software has been loaded and initialized, the operator types a ↑S on the PDP-15 T4002A. As a safeguard against premature outputting, the module is loaded under DDT. To start the program type KEY11B$B. A 1 will be placed after the string and a carriage return

effected by the DDT software. Then type $G to start. This causes the software to present the "Data Selection" display (Figure V-2). The operator must now define the features and areas that he is going to operate against and whether symbols are to be on or off. He controls these functions by typing a 1, 2, or 3 for the desired function. When finished, he inputs a "4" to proceed to the Compilation phase. Throughout the following instruction, the commands ↑EOT and ↑EOM are referenced. To produce ↑EOT on the keyboard type ↑D; to produce ↑EOM, type ↑T.

5.2.1.1 Feature Selection.

When the operator types in a "1", on the "Data Selection" display, the "Feature Selection" display shown in Figure V-3 is presented on the text tube.

The software allows up to 5 extracts to be input by the operator. These extracts are based on the 14 character RFSC code which is carried in all MMS header records. The definition of the RFSC codes has been presented in other RADC reports and it is assumed that the reader understands their usage.

To enter an extract the operator types in the 14 character field followed by a "Carriage Return (CR) or Control EOT (↑EOT)". The "CR" is used if another extract is to be entered while "↑EOT" is used in place of the "CR" for the last extract, thus defining the end of the Feature Selection process.

The operator need only enter the characters for which he desires an extract. For example, if he wants to display all features he types "34" followed by " EOT". To display all features, point symbols, and alphanumeric type "3" followed by "↑EOT" the space key is used as a fill character when setting up masks. The reader

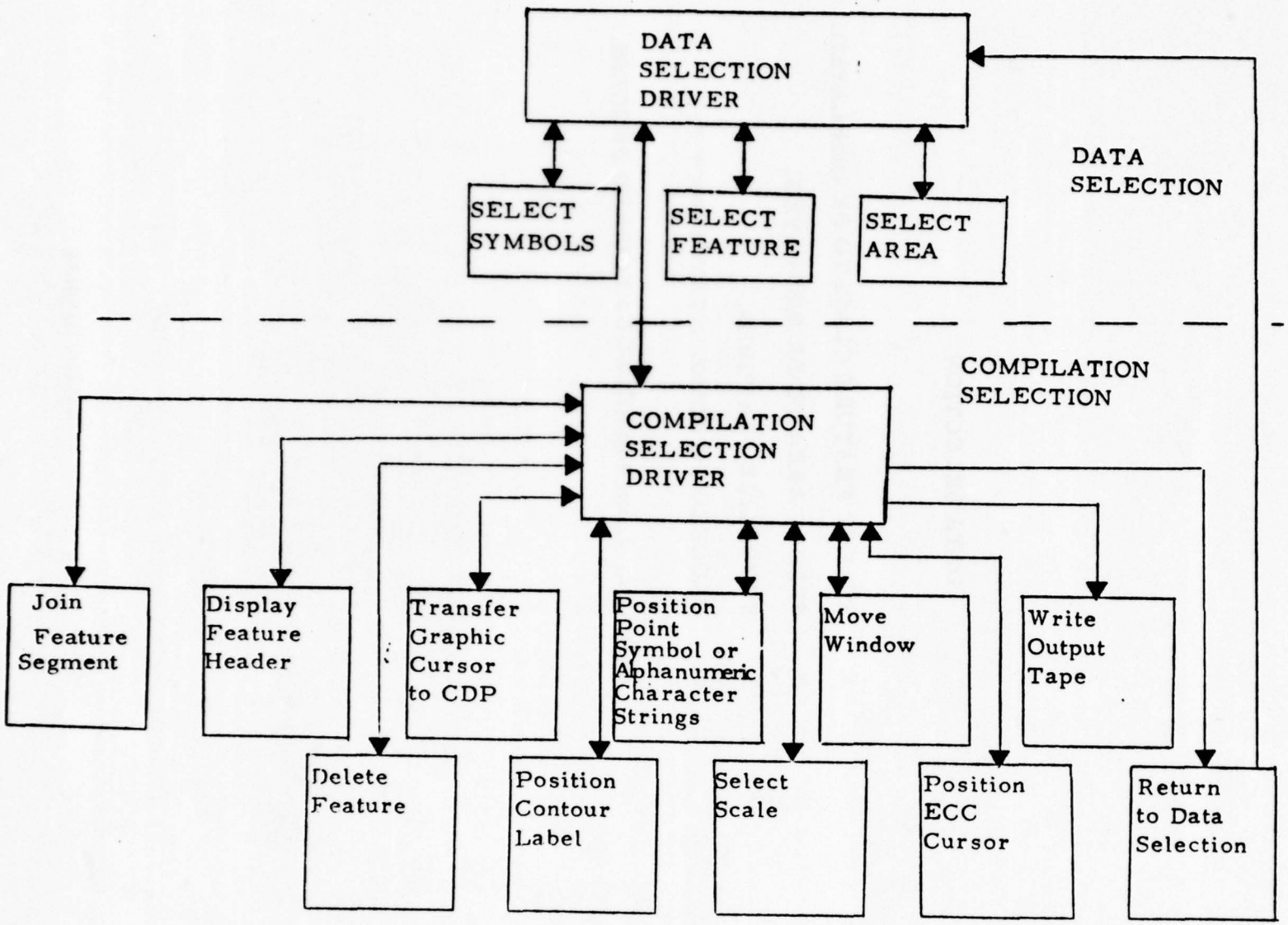


Figure V-1 ECC Software Functional Flow

DATA SELECTION

1. SELECT FEATURE CLASS TO BE DISPLAYED.
2. SELECT AREA TO BE DISPLAYED.
3. SYMBOLIZE FEATURES.
4. PROCEED TO COMPILATION FUNCTIONS.

Type 1, 2, 3, or 4 to SELECT REQUIRED PROCESS.

Figure V-2 - Data Selection Display

SELECT FEATURE CLASS

TYPE RFSC IN RRFFFFSSSSCCCC FORMAT.
UP TO FIVE FEATURE CLASSES MAY BE
DEFINED. FOLLOW THE LAST FEATURE
CLASS BY AN EOT. RRFFFFSSSSCCCC

Figure V-3 - Feature Extract Display

is urged to study the usage of the RFSC codes within the ECF to fully understand the meaning of the various extracts.

Once the operator has input "↑EOT" the Feature Selection display is erased and the Data Selection display, Figure V-2, is redisplayed. The operator is now ready to enter other data selection criteria.

5.2.1.2 Area Selection

Area Selection is activated by typing a "2" on the Data Selection display (Figure V-2). It causes the system to present the Area Selection display (Figure V-4) and then wait for operator input.

The graphic CRT (T611B) used for displaying the cartographic data is 8" X 6" in X and Y while the CDP is 32" X 30". The ECC data base is based on 4" X 3" windows to maximize the system response time. One graphic display at 1X is composed of four windows which combine to make up a 8" X 6" display screen. At 2X magnification one 4" X 3" window completely fills the 8" X 6" screen.

The "Area Selection" display presents the 80 CRT windows and asks the operator to select one of them. The window the operator selects becomes the lower left hand window of the 4 window display at 1X. For example, if the operator selects A1 his display will contain windows A1, A2, B1, and B2. The same relationship holds true for whichever window he selects.

If the operator selects an area which has no data, the graphic display to be presented will be blanked out for the non-data windows.

SELECT AREA OF INTEREST

J1	J2	J3	J4	J5	J6	J7	J8
I1	I2	I3	I4	I5	I6	I7	I8
H1	H2	H3	H4	H5	H6	H7	H8
G1	G2	G3	G4	G5	G6	G7	G8
F1	F2	F3	F4	F5	F6	F7	F8
E1	E2	E3	E4	E5	E6	E7	E8
D1	D2	D3	D4	D5	D6	D7	D8
C1	C2	C3	C4	C5	C6	C7	C8
B1	B2	B3	B4	B5	B6	B7	B8
A1	A2	A3	A4	A5	A6	A7	A8

TYPE THE 2 CHARACTER AREA CODE TO SELECT THE REQUIRED AREA.

Figure V-4 – Area Selection Display

After the operator has entered the two-character window code, the "Area Selection" display is erased and the "Data Selection" display presented, unless the operator has made an error in data entry. If an error has been made, the "Area Selection" display is redisplayed and the operator continues as if he had made no error.

5.2.1.3 Symbolization

If the operator enters a "3" while the "Data Selection" display (Figure V-2) is active, the software symbol flag will be turned on. Any graphic display written while this flag is on will have symbols applied to all features.

The symbol used by the ECC software is the first character of the 4 digit F code. This code defines the class to which the feature belongs. If the symbol flag is set, all features will be symbolized with the first digit of the F code except contours. Since contours run very close to each other, it was decided that contours would not be symbolized. Symbolization could possibly cause the display to be too cluttered to use effectively.

After the operator has typed his "3" symbols, the "Data Selection" display is represented and the operator may continue with his data selection.

5.2.1.4 Proceed to Compilation

After the operator has selected his features, area, and symbolization, he is ready to go to the ECC Compilation phase. This is accomplished by entering a "4" on the "Data Selection" display. If the data selection data has all been entered, the "Data Selection" display is erased and the graphic data and compilation display are presented, if

not the "Data Selection" display is represented. This occurs only when the operator has not yet selected both a feature extract and an area to be presented. Once the operator has met both these requirements, typing a "4" will cause the system to enter the compilation phase.

5.2.2 Compilation

Once the operator has entered his data selection inputs and called for Compilation by striking the proper key, the " Compilation Function" display (Figure V-5) is presented on the textual tube while the selected graphic data is presented on the graphic tube.

Examination of the "Compilation Function" display shows that the operator has eleven functions available to support compilation. The eleven functions and the reports sections which explain them are as follows:

Function		Section Number
1.	Display Header	5.2.2.1
2.	Delete Feature	5.2.2.2
3.	Insert Contour Labels	5.2.2.3
4.	Position Point Symbols and Text	5.2.2.4
5.	Transfer Graphic Cursor to CDP	5.2.2.5
6.	Join Contour Segments	5.2.2.6
7.	Select Scale	5.2.2.7
8.	Move Window	5.2.2.8
9.	Position Graphic Cursor	5.2.2.9
10.	Return to Data Selection	5.2.2.10
11.	Write Output Tape	5.2.2.11

COMPILATION FUNCTIONS:

1. DISPLAY HEADER. *
2. DELETE FEATURE. *
3. INSERT CONTOUR LABELS. *
4. POSITION POINT SYMBOLS AND TEXT. *
5. TRANSFER GRAPHIC CURSOR TO CDP. *
6. JOIN CONTOUR SEGMENTS.
7. SELECT SCALE.
8. MOVE WINDOW. **
9. POSITION GRAPHIC CURSOR.
10. RETURN TO DATA SELECTION.
11. WRITE OUTPUT TAPE.

TYPE 1 THRU 11 TO SELECT FUNCTION.

* SELECT FEATURE BY PLACING CURSOR ON THE FEATURE AS DISPLAYED ON THE GRAPHIC CONSOLE (FUNCTION 9) BEFORE SELECTING FUNCTION.

** PLACE GRAPHIC CURSOR ON THE WINDOW REQUIRED.

Figure V-5 – Compilation Display

5.2.2.1 Display Header

To display and modify a header, the operator must first have identified the feature of interest via function 9 "Position Graphic Cursor." Once a feature has been cursored, he types in a "1" followed by a CR to find the feature and display its header. If found, a "Z" will be displayed at the cursor position and an "L" at the end of the feature located. If not found, "ERROR" is printed on the T4002A and the operator must try again.

The "Header" display (Figure V-6) is now presented on the text tube. It contains 92 characters of header data divided into nine fields. The first four fields are the 14 character RFSC codes used as extracts in the data selection function. The other fields are not used as extract masks but contain textual expansions of the octal RFSC codes except for field 9 "Elevation" which is a six character item taken directly from the MMS record.

To modify the MMS header, the operator types in the number of the field to be modified (1-9). The software will put a textual cursor in the first position of the field requested. The operator now inputs his changes, between the parenthesis, directly beneath the original field. The field must be padded out using blanks if necessary until the last character has been used. At this point, the operator enters a CR to signify that he has finished with his chosen field.

At this point, he has two choices: to continue modifying header fields as above, or to have the data base updated by entering "↑EOT." When "↑EOT" has been entered, the header modification software takes the changed data entered by the operator and updates CDP and Plot files. After the data file update is complete, the "Compilation Function" display (Figure V-5) is presented and the operator continues with other compilation functions.

DISPLAY HEADER RECORD

```
1.   R:XX
       (  )

2.   F:XXXX
       (    )

3.   S:XXXX
       (    )

4.   C:XXXX
       (    )

5.   FEATURE:XXXXXXXXXXXX
              (              )

6.   SUBFEAT:XXXXXXXXXXXX
              (              )

7.   FEAT-TYPE:XXXXXXXXXXXX
                 (              )

8.   FEAT-DESC:XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                 (    )

9.   ELEVATION:XXXXX
                 (      )
```

TO MODIFY ONE OF THE 9 FIELDS, TYPE THE NUMBER OF THE FIELD.

MARKER WILL BE POSITIONED TO START OF FIELD.

TYPE IN CORRECTION FOLLOWED BY A RETURN.

SELECT NEXT FIELD TO MODIFY.

HIT EOT FOR NEXT FIELD SELECT TO COMPLETE FUNCTION.

Figure V-6 - Header Display

5.2.2.2 Delete Feature

Delete Feature is called by entering a "2" followed by a CR via the keyboard after the feature to be deleted has been selected via key "9" (Section 5.2.2.9). If symbols are off, the feature selected will be deleted; if symbols are on, and the feature has been deleted previously, it will be reinstated.

Deleted features have an "E" plotted as their symbol. Once it is reinstated, the two "E"s at the ends are overprinted with "A"s.

Features have an "E" plotted at their ends when they have been deleted.

5.2.2.3 Insert Contour Label

The Insert Contour Label function provides the ECC with the capability of positioning contour labels, i.e., elevation on specified contours. The selected contour must contain the desired elevation in the elevation field of its Header. The Display Header function (see Section 5.2.2.1) can be used to review or change the elevation field of the specified contour.

To select this function, the operator types a "3" followed by a CR. The "Generate Contour Label" display (Figure V-7) is presented on alphanumeric display. The operator positions the pen down on the graphic tablet, moves the graphic cursor to the position on the contour which he desires to locate the first digit of the contour label, and releases the pressure on the pen. He then presses the pen down a second time to register his point of origin. Next, he traces along the base line about which he wishes to orient the contour label while holding the pen down. When he has reached the termination point of the base line, he again releases pressure on the pen and

GENERATE CONTOUR LABEL

A. POSITION CURSOR ON BASE LINE ORIGIN

B. VERIFY CURSOR POSITION AND SELECTED CONTOUR

1. TYPE RETURN TO REDEFINE ORIGIN
2. TYPE EOM TO DEFINE BASE LINE END POINT
3. TYPE EOT TO ABORT

POSITION CURSOR ON BASE LINE END POINT

1. TYPE RETURN TO REDEFINE END POINT
2. TYPE EOM TO PLOT CONTOUR LABEL
3. TYPE EOT TO ABORT

Figure V-7 - Generate Contour Label Display

presses it down for the third time to define the end point of his base line. If the operator is using the joystick instead of the pen, the procedure is similar. He first positions the joystick over the desired base line origin point and presses any key on the T4002A keyboard. The same procedure is repeated for the base line end point. Both base line end points must lie on the contour he wishes to label. If these points do not lie on a plotted contour, the "Position Contour Label" display will be erased and immediately reappear indicating to the operator that a point is in error. He may proceed by selecting new points and retracing the base line.

The contour label will be plotted on the graphic CRT, and the "Review Contour Label" display (Figure V-8) will be generated on the alphanumeric CRT. If the operator is satisfied with the positioning of the contour label, he types control T (↑T) which causes the contour label (i.e., the Pseudo-MMS record for the contour label) to be added to the CDP file. If he wishes to delete the plotted contour label and regenerate it, he types control EOT (↑EOT); the contour label is deleted and return is made to the Compilation Function display.

5.2.2.4 Position Point Symbols and Text

The "Position Point Symbols and Text" function is entered by selecting key "4" followed by a CR. A skeletal Pseudo-MMS Header record is presented by the "Pseudo-MMS Record" display (Figure V-9) on the textual CRT.

The operator must perform two operations to generate point symbols or alphanumeric text: 1) he must define a Pseudo-MMS Header record, and 2) he must generate a Pseudo-MMS Data record.

The Pseudo-MMS Header is defined by inserting values in the "Pseudo-MMS Record" display. Point Symbol generation requires an

REVIEW CONTOUR LABEL

TYPE CONTROL EOT TO DELETE PLOTTED CONTOUR LABEL

TYPE CONTROL EOM TO GENERATE CONTOUR LABEL RECORD

Figure V-8 - Review Contour Label Display

PSEUDO-MMS RECORD

		POINT SYMBOL	ALPHANUMERIC
1.	R-CODE __	33	35
2.	F-CODE _ _ _ _	POINT SYMBOL #	TYPE STYLE
3.	S-CODE _ _ _ _		TYPE SIZE
4.	C-CODE _ _ _ _		TYPE MODE
5.	TEXT FIELD *		

- - - - - - - - - - - - - - - - -
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A. TYPE SELECTED FIELD NUMBER

B. INPUT REQUIRED VALUE IN SELECTED FIELD
FILL ENTIRE FIELD AND/OR PRESS THE RETURN KEY

C. REPEAT STEPS A & B UNTIL ALL REQUIRED PARAMETERS ARE COMPLETED

D. TYPE EOM TO DEFINE BASE LINE

E. TYPE EOT TO ABORT RECORD DEFINITION

* A SLASH SIGNIFIES THE END OF TEXT FIELD

Figure V-9 - Pseudo-MMS Record Display

R-code of 33 and an F-code specifying the point symbol number (see Appendix G). Alphanumeric text generation requires an R-code of 35, an F-code specifying type style (Appendix H), an octal S-code specifying type size, a C-code (Appendix H), and the desired text followed by a slash character (/).

Upon completing the required data items in the Pseudo-MMS reocrd, the operator types CONTROL T (↑T) in order to generate the Pseudo-MMS data record. This record contains the end points of a base line about which the point symbol or alphanumeric text are oriented. The control T (↑T) initiates the generation of the "Draw Base Line" display (Figure V-10) upon the textual CRT and places the curosr upon the graphic CRT. The end points of the base line are defined by use of the graphic tablet or joystick. The operator places the pen down and moves the cursor while maintaining pressure to the initial coordinate of the base line. He momentarily releases pressure and the pen is again pressed down to register the origin and moved along the base line to the terminal coordinate. The pen is again lifted and pressed down to register the terminal coordinate. Similarly, the joystick is moved to the desired location and a key is struck on the T4002A keyboard for each input point. The registration of the second point initiates the plotting of the base line of the graphic CRT. The operator may redefine the base line if he is unsatisfied with its position by striking the "RETURN" key and redrawing the line. Otherwise, he may plot the specified point symbol or alphanumeric string by typing CONTROL T (↑T).

In response to the CONTROL T (↑T), the specified point of alphanumeric symbols will appear on the graphic CRT, and the "Review Plotted Symbols" display (Figure V-11) will appear on the textual CRT.

1. PLACE PEN DOWN ON GRAPHIC TABLET
2. POSITION CURSOR BY MOVING PEN
3. PLACE PEN DOWN TO REGISTER POINT SYMBOL OR ALPHANUMERIC CHARACTER POSITION
4. MOVE PEN ALONG DESIRED BASE LINE
5. PLACE PEN DOWN TO REGISTER TERMINAL POINT ON BASE LINE

A. IF THE BASE LINE IS TO BE PARALLEL TO THE X-AXIS, STEP 4 MAY BE OMITTED: I.E., THE PEN MAY BE PRESSED DOWN TWO SUCCESSIVE TIMES AT ITS INITIAL POSITION AND/OR TYPE KEY 0.

B. TYPE EOM TO PLOT THE SYMBOL OR STRING

C. TYPE RETURN IN ORDER TO REDRAW THE BASE

D. TYPE EOT TO ABORT THE RECORD DEFINITION

Figure V-10 - Draw Base Line Display

REVIEW PLOTTED PSEUDO-RECORD

1. SATISFACTORY RESULTS
   - RETURN TO COMPILATION FUNCTION SELECTION

2. INCORRECT POINT SYMBOL OR ALPHANUMERIC TEXT
   - RETURN TO PSEUDO-MMS RECORD DISPLAY

3. INCORRECT ORIENTATION
   - RETURN TO DRAW NEW BASE LINE

4. POINT SYMBOL AND TEXT ORIENTATION INCORRECT
   - DEFINE COMPLETE NEW PSEUDO-MMS RECORD

PRESS EOT TO ABORT PSEUDO-MMS RECORD AND RETURN TO COMPILATION FUNCTION SELECTION

Figure V-11 - Review Plotted Symbols Display

The operator can choose any of four following options by selecting key "1", "2", "3", or "4" respectively.

1. Add the Pseudo-MMS record for the displayed point symbol or alphanumeric record to the CDP file.
2. Alter only the Pseudo-MMS Header record definition while retaining the Data record.
3. Alter only the Pseudo-MMS Data record definition while retaining the Header record.
4. Redefine both Pseudo-MMS Header and Data Record definitions.

If "1" is selected the plotted symbols will be permanently added to the MMS data file. If "2", "3", or "4" are selected, parameters can be changed by the operator and the updated symbols will be plotted for his review.

5.2.2.5 Transfer Graphic Cursor to CDP

This function is used to drive the CDP stylus to the same X, Y location on the CDP as the ECC cursor indicates. The cursor is enabled and entered at the proper feature via a key "9", the feature is then "found" via a key "1" and key "5" is entered to transfer the feature X, Y and ID to the CDP. Each of the above keys must be followed by a CR. When finished both the ECC cursor and the CDP stylus are at exactly the same relative X, Y position.

5.2.2.6 Join Contour Segments

The "Join Contour Segments" function is entered by selecting key "6" followed by a CR. The "Specify Contour Segments to be Joined" display (Figure V-12) is presented on the T4002A textual CRT. The

operator must first select the window containing the contour segments to be joined. The selected window becomes the lower left window and is displayed on the T611B. The operator types EOM if the displayed window is not the desired window, or he types "3" to accept this window. He then specifies the feature segment to be joined by moving the pen or joy-stick until it is one the desired segment and executing an interrupt (lifting the pen or striking a key on the T4002A keyboard, respectively).

The "Join Contour Segments" display is then presented on t he T4002A (Figure V-13). The operator types the desired number as presented in the display:

No. Typed	Purpose
1	Retain window number and return to specify additional segments
2	Define new window number and return to specify additional segments
3	Redefine last feature segment
4	Join segments as specified and return to compilation function
5	Join segments on closed feature and return to compilation function
6	Abort segment definitions and return to compilation function

Any feature which has been joined in the above manner may not be references again during the same ECC run.

5.2.2.7 Select Scale

When key "7" followed by a CR is entered on the "Compilation Function" display, the "Select Scale" display (Figure V-14) is presented to the operator. The operator enters a "1", "2", or "3" to select the desired scale.

SPECIFY CONTOUR SEGMENTS TO BE JOINED

1. TYPE WINDOW NUMBER CONTAINING SEGMENT TO BE JOINED

2. IF SELECTED WINDOW NUMBER INCORRECT, TYPE CONTROL T AND REPEAT STEP 1, OTHERWISE TYPE 3 AND CONTINUE

3. SPECIFY CONTOUR SEGMENTS TO BE JOINED BY POSITIONING CURSOR ON SEGMENT

MAXIMUM NUMBER OF SEGMENTS IS 20

Figure V-12 - Specify Contour Segments to be Joined

JOIN CONTOUR SEGMENTS

DEFINE ADDITIONAL CONTOUR SEGMENTS

1. RETAIN WINDOW NUMBER
2. DEFINE NEW WINDOW NUMBER
3. REDEFINE LAST CONTOUR SEGMENT

SELECT JOIN FUNCTION

4. JOIN SEGMENTS
5. CLOSE - JOIN SEGMENTS
6. ABORT - RETURN TO COMPILATION FUNCTION MENU

TYPE SELECTION NUMBER

Figure V-13 - Join Contour Segments

SELECT SCALE:

1. 1.0X SCALE
2. 2.0X SCALE
3. 4.0X SCALE

TYPE 1, 2, or 3 FOR DESIRED SCALE

Figure V-14 - Change Scale Display

If he enters a "1", the graphic display presented will contain four windows at 1X. When he enters a "2", the display will contain one window at 2X. The window used is the lower left hand window of the normal 1X display.

If the operator chooses a 4X by entering a "3", his display is based on the lower left quadrant of the window selected by a 2X scale factor.

5.2.2.8 Move Window

The "Move Window" function provides a method of moving the display area presented on the graphic CRT without returning to the " Data Selection" function.

To use this function, the operator moves the cursor to a window of the present display which he wishes to be used as the lower left window of the new display and registers this window by typing "9" CR to "Position Graphic Cursor." When he types an "8" followed by a CR on the "Compilation Function" display, the cursor position is read and a new display is generated using the designated window as the lower left quadrant.

5.2.2.9 Position Graphic Cursor

This function is used to position the graphic cursor on the CRT. When the operator enters a "9" followed by a CR from the keyboard, the cursor is turned on and the Graphic Tablet or joystick is enabled.

To position the cursor, the pen is applied to the surface of the tablet and moved until the displayed cursor is at the proper position on the CRT. The operator now lifts the pen from the tablet surface and reapplies it. This signals to the system that the cursor coordinates are

to be saved. When using the joystick, move it to the desired location and strike a key on the T4002A keyboard. After this, the "Compilation Function" display is represented and the system waits for further operator inputs.

5.2.2.10 Return to Data Selection

This function is activated by typing a "10" followed by a CR and causes the system to re-enter the "Data Selection" mode as defined in Section 5.2.1.

5.2.2.11 Write Output Tape

Activating this function by typing "11" followed by a CR and a control T (↑T) causes the system to remove any features flagged for deletion from the CDP file. The control T key is a fail safe to avoid accidental termination. Any key other than a control T will return the system to compilation function display. To proceed with output, type "$P".

The list (DEL) of features is sent to the PDP-9 where the deletion takes place. Upon successful completion, the PDP-9 teletype will type "DONE". The operator should run the CDP Output program as described in Section 5.1.3 to save the results of his work session.

SECTION VI

SYSTEM GENERATION

6.1 PDP-9 SYSTEM

This section assumes the reader is familiar with programming and system operation of the PDP-9. The discussion which follows concerns itself with regenerating the three basic PDP-9 subsystems of the CDP/ECC System. As for the PDP-9 Monitor V4E, it may be reproduced using the standard DEC procedures. However, it must have included in its library the Interprocessor Buffer Handler (DBA.). Program DBA. may be obtained from the DECtape containing the "I/O Processor" binary files.

6.1.1 Input Processor

The Input Processor is made up of 22 subroutines as well as 20 standard system library routines. The subroutines which make up the Input and Output Processors have been combined on one DECtape. A library (. LIBR) is also provided on the same tape. This DECtape should be transferred to a Disc unit (example uses #2) using the copy (H mode option) function under PIP.

To build a load module, make the proper monitor assignments and call the LOADER. Once all the subroutines are in core and the load complete, call for a "Q" save on Disc 0 instead of a Control S. This will put a core image on the system Disc, use PIP to copy the new version of the system Disc 0 to DECtape.

The following is a step by step procedure to produce a new Input Processor. Underline indicates monitor print out.

a. Assign Disc 2 to Input and user Library and assign tape unit 1.

   $A␣DKC2␣-4␣-5/MTF1␣7↓
   (↓=Carriage Return)

b. Call for the Loader.

   $LOAD↓

c. Give program name to be loaded.

   LOADER V4A
   >INPUT ALT (ALT MODE KEY)

d. Each subroutine name will be printed as it is loaded. When finished set up a "Q" save.

   S↑ Q0 (↑=CTRL KEY)
   MONITOR V4E

e. The Input Processor is now regenerated and stored on system Disc 0.

6.1.2 CDP/ECC On-Line

The CDP/ECC ONLINE program is made up of 50 subroutines and 18 standard system library routines. The 48 subroutines along with a library contained on a DECtape labeled "CDP/ECC ONLINE BIN and . LIBR". The same general procedure as outlined in Section 6.1.1 for the Input Processor should be followed. That is, PIP the contents of the DECtape to a Disc unit, then call the loader, and finally make a "Q" area save. It is recommended that the CDP/ECC ONLINE program be stored on a separate DECtape along with the on-line library.

The following is a step by step procedure to produce a new CDP/ECC ONLINE program. Underline indicates monitor print out.

a. Assign Disc with binary and . LIBR to input and user library slots. Inter-processor buffer must also be assigned.

   $A DKC2 -4 -5/DBA 10/MTF2 7
   (↓Carriage Return)

b. Call for loader.

   $LOAD↓

c. Give program names to loader.

   LOADER V4A
   >EXEC, NINEXC, DISCTR, ADDREC ALT (ALT MODE)

d. Each routine name will be printed as it is loaded. When finished do a "Q" save.

   ↑S↑Q4 (↑=CTRL KEY)
   MONITOR V4E

e. The On-Line program is now regenerated COPY it to tape using PIP.

6.1.3 Output Processor

The OUTPUT PROCESSOR is made up of 16 subroutines and 19 standard system library routines. The subroutine binary files and library are on the DECtape labeled "I/O PROCESSOR BIN". This DECtape should be transferred to a Disc unit (example uses #2) with the COPY (H mode option) function under PIP.

The OUTPUT PROCESSOR occupies only one bank of PDP-9 core when loaded, therefore, an execute file may be produced. There is an unresolved bug in the DEC CHAIN program, however, it does not affect programs of less than one bank. CHAIN builds its output file on DECtape.

Mount a DECtape for this use. When the execute file has been built, transfer it by name (OUTPUT XCT) to the system Disc 0. Keep a copy of the updated system Disc (Disc 0 to DECtape with PIP) on DECtape.

The following is a step by step procedure to build the execute file on DECtape unit 1. Underline indicates monitor print out.

a. Make monitor assignments of binary input and user library as well as output file.

   $A␣DKC2␣-4,␣-5/DTA1␣-6↓
   (↓Carriage Return)

b. Call for CHAIN program.

   $CHAIN↓

c. Type CHAIN input parameters.

   CHAIN V3A
   ›BUILD OUTPUT
   ›C 1
   ›OUTPUT E ALT (ALT MODE)

d. The subroutines names will be printed as they are loaded.

e. Close out the file. Tape will now be written.

   CHAIN# 1
   LOWEST XXXXX
   COMSZE 00000
   ›CLOSE

f. Return to monitor. Make update to system Disc and save on tape.

   CHAIN V3A
   ›↑C

6.1.4 Pseudo-MMS Conversion

The Pseudo-MMS Conversion routine (PSUMMS) contains only twelve subroutines. The source and binary modules for each of these subroutines is contained on the PSUMMS SRC/BIN DECtape No. 611. Mount this DECtape on DECtape unit No. 0. DECtape will receive the PSUMMS execution module after the LOADER has linked the subroutine.

The following is a step by step procedure to produce the new PSUMMS execution module. Underline indicates monitor print out.

a. Type Control C (↑C) (re-bootstrap or load if necessary, see 5.1.4, page V-4).

   DOS - 15 V1A

   $

b. Type

   A␣DT0␣-4/MTF1␣5/MFT2␣6/MTF3␣7/

c. $ LOAD

   BLOADER V12A

d. Type

   P←PSUMMS, GEPDP9, PDP9GE, CSCALE, SPACE
   TRIG, ROTATE, INTERR, DISCTR, GLOBLX
   MATCH, TOLER ALT (Alt mode key)

   Each subroutine name will be printed as it is loaded.

   ↑S

e. Type ↑Q

   DOS-15 V1A

   $

f. Type

$A_{\Delta}DT0_{\Delta}-14$

$

g. Type

$PUT_{\Delta}PSUMSL_{\Delta}BIN$

$

The execution module for PSUMMS now resides on PSUMMS DECtape No. 611 under the name PSUMSL BIN.

6.2 PDP-15 SYSTEM

The PDP-15 System for the ECC consists of two DECtapes: 1) the ECC Monitor Tape, and 2) the ECC Application Tape. This section of the manual presents the method to be used in generating the tapes.

6.2.1 KMS9-15 V5B

Figure VI-1 shows the directory listing for this tape. It is a standard DEC Monitor except for the . LIBR5, DBA handler, and skip chain order. Figure VI-2 shows the system data and DAT slot assignments.

If the DEC SGEN program is used to create a new system, it should be generated as in Figure VI-2. The . LIBR5 is contained on the ECC Application Tape and should be placed on the system tape using PIP.

6.2.2 ECC Application Modules

Figure VI-3 shows the directory listing of the ECC software for the PDP-15. DBA. is the handler for the Inter-Computer Buffer unit and is incorporated in the Monitor .LIBR during SGEN. DMY1 and DMY2 are two one-word programs used to make the start and end of the . LIBR5.

DIRECTORY LISTING

222 FREE BLKS
13 USER FILES
416 SYSTEM BLKS

.LOAD	BIN	36	10
DDT	BIN	37	13
EXECUT	BIN	40	3
INTEAE	BIN	41	1
INTNON	BIN	47	1
RELEAE	BIN	54	4
RELNON	BIN	77	4
.LIBR	BIN	225	76
FOCAL	BIN	235	23
FNEW	SRC	240	15
.LIBR5	BIN	243	42
KM9-15	SYS	0	
SKPBLK	SYS	42	
IOBLK	SYS	46	
SGNBLK	SYS	52	
SYSHAN	SYS	56	
SYSBLK	SYS	61	
.SYSLD	SYS	62	
BITMAP	SYS	71	
DIRECT	SYS	100	
QAREA	SYS	101	
EDIT	SYS	661	
PIP	SYS	673	
MACRO	SYS	713	
CHAIN	SYS	751	
F4	SYS	771	
DUMP	SYS	1024	
PATCH	SYS	1030	
UPDATE	SYS	1037	
SGEN	SYS	1047	

Figure VI-1 - ECC Monitor Directory Listing

```
SYSTEM INFO-V5A

37646 - BOOTSTRAP RESTART ADDR
37636 - 1 ST FREE CELL BELOW BOOTSTRAP
1755 - 1 ST FREE CELL ABOVE RESIDENT MONITOR
141 - ADDR OF .DAT
566 - Q ADDRESS FOR MANUAL DUMP
101 - START BLOCK FOR Q DUMP AREA
255 - KMS9-15 START WITH RESTART ADDRESS IN CELL Ø
SYSTEM HAS EAE
I/O HANDLERS AVAILABLE:
TTA TELETYPE: I/O, ASCH MODES, ALL FUNCTIONS
PRA TAPE READER: INPUT, ALL MODES, ALL FUNCTIONS
PPA PUNCH: OUTPUT, ALL MODES, ALL FUNCTIONS
DTA DECTAPE: 3 FILES, I/O, ALL MODES, ALL FUNCTIONS
DTB DECTAPE: 2 FILES, I/O, IOPS MODES, LIM FUNCTIONS
DTC DECTAPE: 1 FILE, INPUT, IOPS MODES, LIMITED FUNCTIONS
DBA
SKIP CHAIN ORDER
            SPFEAL
            7Ø22Ø1
            DTDF
            CLSF
            RSF
            PSF
            KSF
            TSF
            DTEF
            MPSNE
            MPSK
            SPE

.DAT          DEVICE          USE
1               DTAØ          USER
2               DTA1          USER
3               DTA2          USER
4               TTAØ          USER
5               PRAØ          USER
6               PPAØ          USER
7               DTA-1         USER
1Ø              DBAØ          USER
$SCOM
```

Figure VI-2 - KMS9-15 V5B System and DAT Data

DIRECTORY LISTING

DBA.	SRC
DMY1	SRC
ONLINE	SRC
DSPLAY	SRC
DSPHDR	SRC
POSCUR	SRC
TABLET	SRC
OUTPUT	SRC
DELETE	SRC
TPLOTX	SRC
TPRINT	SRC
TEKIO	SRC
ICCU	SRC
DATAX	SRC
DMY2	SRC
SMONLX	SRC
PLTSYM	SRC
PSUDEL	SRC
PSUOUT	SRC
BASELN	SRC
TRIG	SRC
SPACE	SRC
CSCALE	SRC
ROTATE	SRC

Figure VI-3 - ECC Application Directory Listing

These dummies allow the 15 application modules to be put on the library in any order. . LIBR5 is updated through the use of the UPDATE program and then inserted on the Monitor tape when it is completed. Figure VI-4 shows the contents of . LIBR5.

To create a new ECC Application Module Q-Tape, follow these procedures (computer responses are underlined):

a. Mount the ECC SRC/BIN (KAY1) DECtape on unit 1, write lock, remote

b. Type ↑C

KMS9-15 V5B

$

Type DDT

DDT

LOADER

≥

Type

P←PART1, PART2, BASELN, PLTSYM, PSUOUT, PSUDEL, CSCALE, SPACE, TRIG, ROTATE ALT (Alt mode key)

Program names are printed as they are loaded.

c. When the load is complete, the response is:

↑Q

Remove the ECC SRC/BIN DECtape (KAY1) and mount the ECC Q-tape (F1), remote, write enable.

Type ↑Q1

d. The system may respond with IOPS4. If so, type ↑R in response and the load will be completed.

e. Upon completion, the response is:

DDT

≥

LIBRARY FILE LISTING FOR . LIBR5

PROGRAM NAME	PROGRAM SIZE	ACTION
DMY1	1	
ONLINE	3257	
DSPLAY	167	
DSPHDR	2163	
POSCUR	5Ø	
TABLET	2ØØ	
OUTPUT	24	
DELETE	1161	
TPLOT	3Ø25	
TPRINT	134	
TEKIO	63	
ICCU	313	
DATA	1Ø137	
DMY2	1	

Figure VI-4 - ECC . LIBR5 Contents

6.3 SYMBOL LIBRARY GENERATION (SYMLIB)

The Symbol Library provides the locus data for the display of various point and alphanumeric symbols by the CDP/ECC.

Symbol Library data tapes can be generated for either point symbols or alphanumeric symbols. Figure VI-5 illustrates an overview of the SYMLIB generation procedure. The GE routine CDLOAD is used to produce the point symbol magnetic tapes from point-symbol-locus data cards (Figure VI-6). The PDP-9 CDP processor is used to trace and digitize alphanumeric symbol pictures to produce the MMS Alphanumeric magnetic tape.

Point-symbol-locus data cards contain both symbol identification data and (x, y) pair locii. Figure VI-6 illustrates data card formats.

The identification card contains two positive signed four digit integer numbers separated by a comma.

Field	Value	Description
I	+9999	Start of point symbol identifier
II	Any positive signed four digit decimal number except +9999	Point symbol identification number (i.e. F-CODE)

NOTE: Field II = +9999 indicates end of file

The (x, y) data card also contains two signed four digit integer numbers separated by a comma. Each card specifies an (x, y) pair in the point symbol locus.

In order to determine the (x, y) pairs which define a point symbol locus, the symbol casing is plotted according to JOG SPECIFICA-

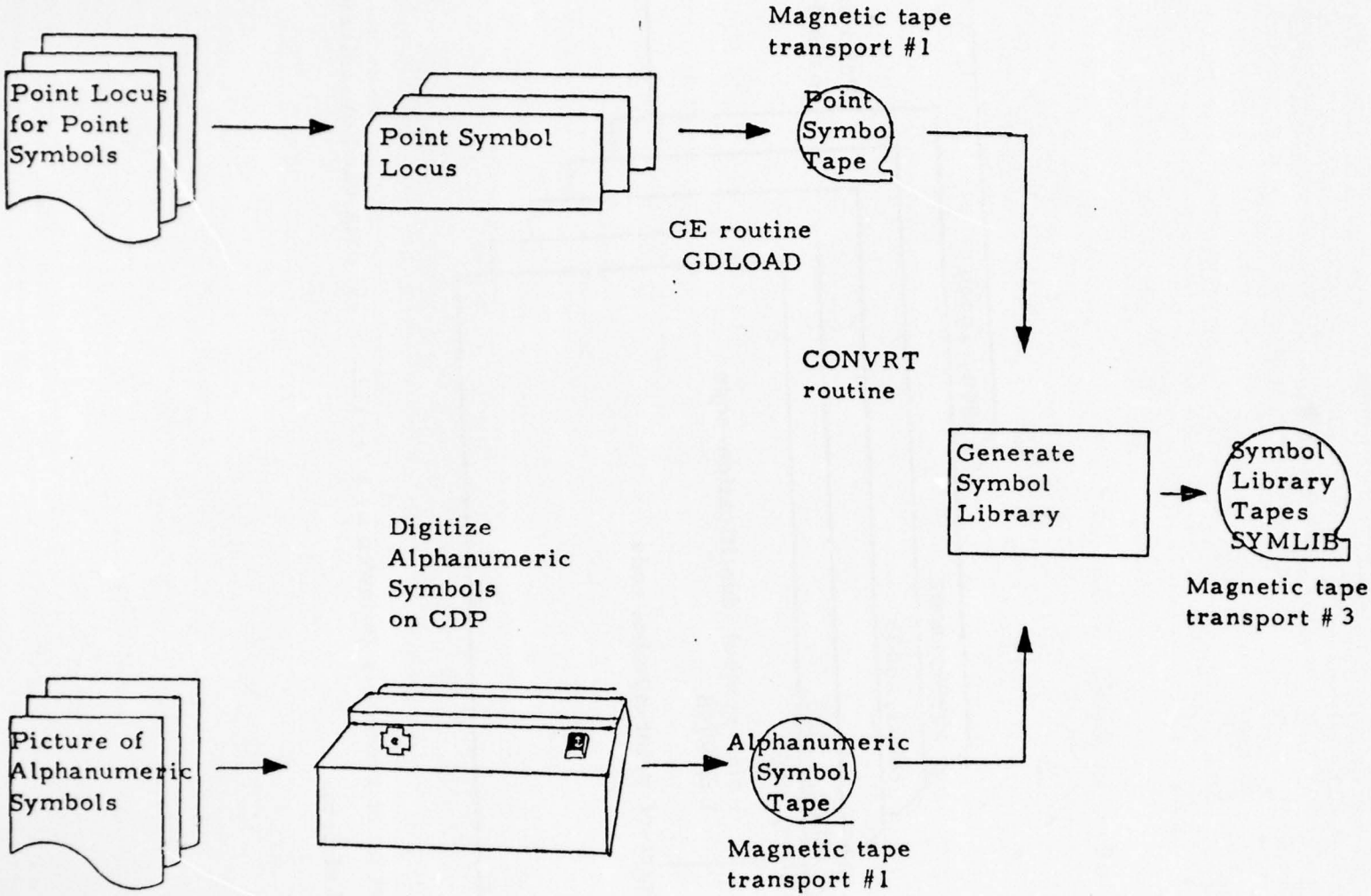
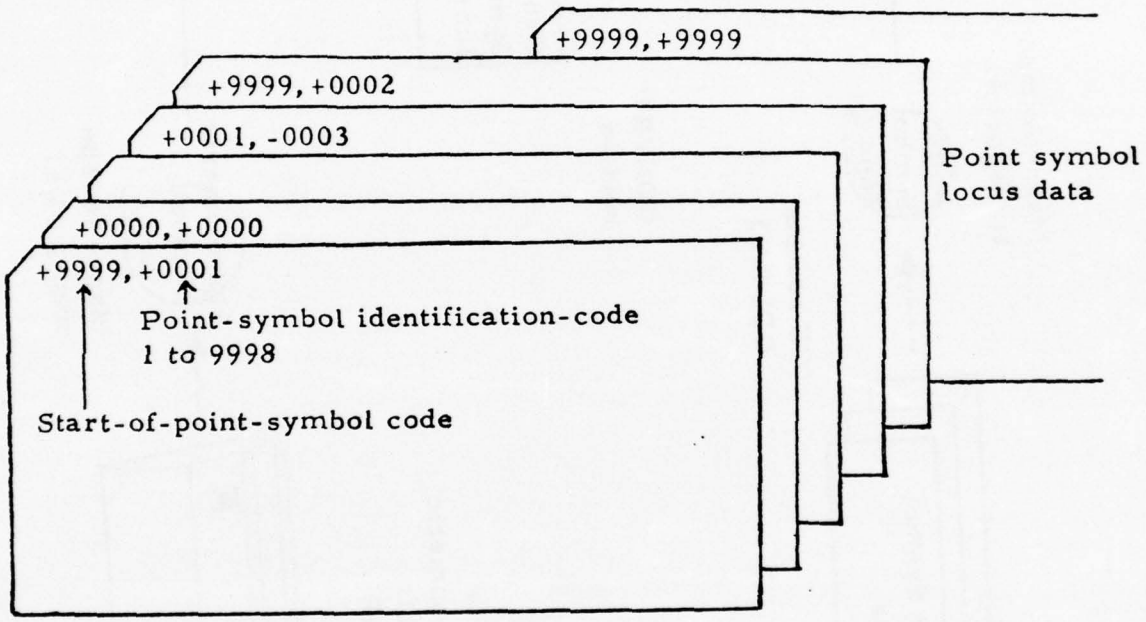


Figure VI-5 - Symbol Library Generation



The last point symbol is followed by a '+9999,+9999' data card to indicate the end of data.

Figure VI-6 - Data Card for CDLOAD

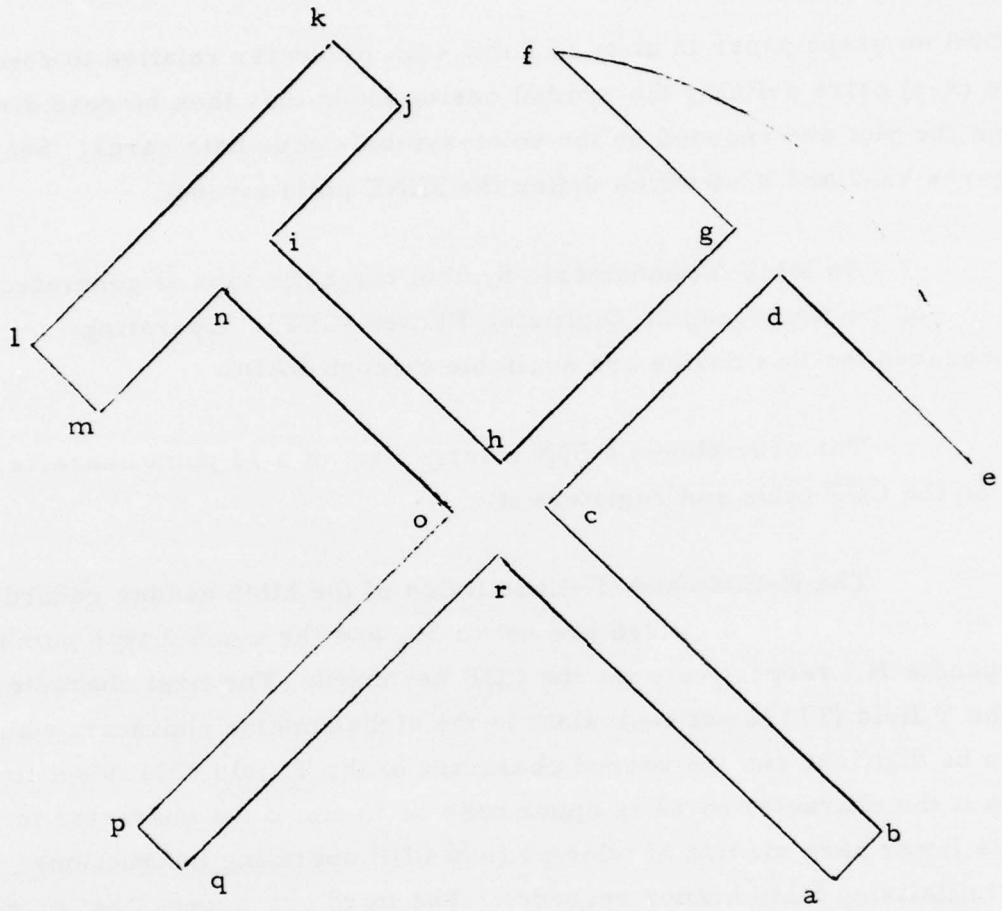
TIONS on graph paper in units of 1 mil with its center relative to zero. The (x, y) pairs defining the symbol casing locus may then be read directly from the plot and encoded on the point-symbol-locus data cards. See Figures VI-7 and VI-8 which define the MINE point symbol.

An MMS Alphanumeric Symbol magnetic tape is generated via use of the Cartographic Digitizing Plotter (CDP). Operating procedures for this device are available through RADC.

The user places a 50X enlargement of a 14 point character set on the CDP table and registers it.

The R-Code and F-Code fields of the MMS header record for the symbol to be digitized are set to 35_8 and the symbol type number (Appendix H) respectively via the CDP keyboard. The first character of the T field (T1) is set equivalent to the alphanumeric character which is to be digitized and the second character of the T field (T2) is set to zero if the character in T1 is upper case or to one if the character in T1 is lower case via use of teletype (see CDP operating instructions for initializing MMS header records). The third character is set to zero for acceptable characters, to 1 for those to be deleted. The user may start to digitize the character anywhere on the casing. However, the entire casing must be traced in a single continuous line.

Figure VI-9 illustrates the method of digitizing the casing of the character "Q". The trace is initiated at point A and continues to point B. At point B, the stylus is moved to the inner edge of the "Q" at point C. The inner edge is then traced until the stylus returns to point C. It is imperative that the line traced from B to C is overlayed with the line traced C to B. (It may be necessary to use either absolute plot points or key in the values for B and C from the CDP keyboard).



a = (36, -40)	g = (25, 30)	m = (-44, 11)
b = (41, -35)	h = (0, 5)	n = (-30, 25)
c = (5, 0)	i = (-25, 30)	o = (-5, 0)
d = (30, 25)	j = (-11, 44)	p = (-39, -35)
e = (51, 5)	k = (-18, 50)	q = (-32, -40)
f = (5, 51)	l = (-50, 18)	r = (0, -5)

Figure VI-7 - MINE # 729

The following equations define the locus of points which describe the point symbols for a horizontal control point, #750. All values of X and Y are integers.

$Y = \frac{26}{15}X + 32 \qquad -20 \leq X \leq 32$

$Y = -\frac{26}{15}X + 32 \qquad -20 \leq X \leq 32$

$Y = \frac{7}{4}X + 27 \qquad -17 \leq X \leq 27$

$Y = \frac{7}{4}X + 27 \qquad -17 \leq X \leq 27$

$X^2 + Y^2 = 16$

Plot points for $X^2 + Y^2 = 16$

X	$\overline{X}$	Y	$\overline{Y}$
0	0	± 4.00	± 4
± 1	± 1	± 3.87	± 4
± 2	± 2	± 3.46	± 3
± 3	± 3	± 2.64	± 3
± 3.46	± 3	± 2	± 2
± 3.87	± 4	± 1	± 1
± 4.00	± 4	0	0

Figure VI-8 - Point Symbols for Horizontal Control Point 750

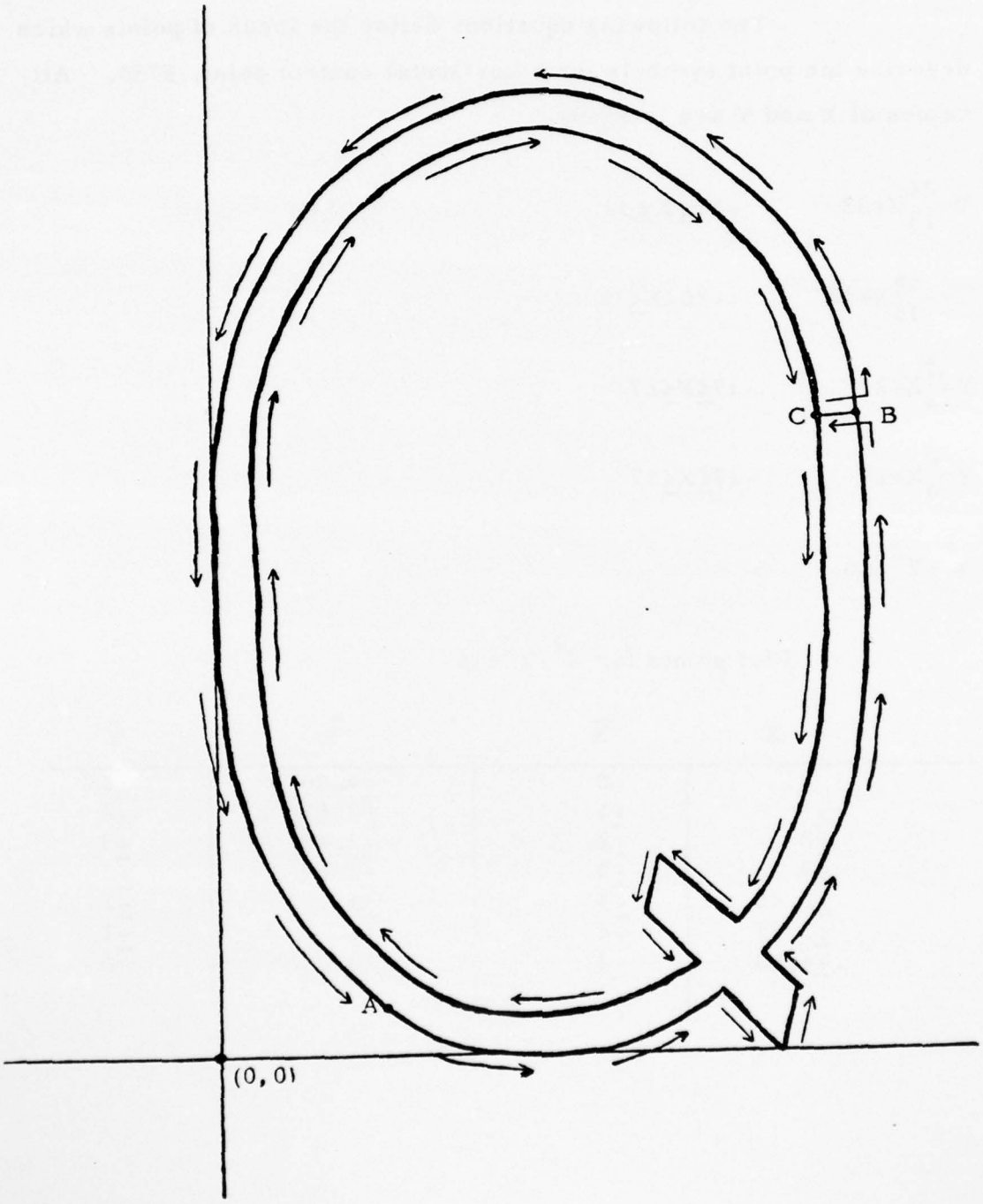


Figure VI-9 - Alphanumeric Digitizing Example

Once point B is again reached, the outer edge is completed. All characters must be digitized so that the inner and outer edges proceed in opposing directions. This enables the area-fill routine to properly fill the character.

The origin for each character need not be separately initialized, the software accomplishes this. Absolute point plotted should also be used where straight lines are to be digitized to minimize the number of points per character.

The PDP-9 routine SYMLIB is then used to convert the Point Symbol and the Alphanumeric Symbol tapes to disc-formatted Symbol Library tapes acceptable to CDP/ECC processor (NINEXC). New point or alphanumeric symbol data can be appended to existing Symbol Library so that the Library can be updated from time to time.

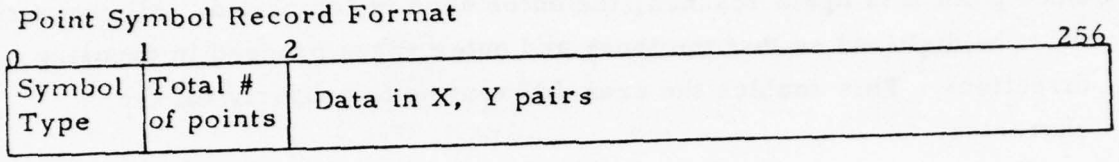
6.3.1 SYMLIB Processor

The SYMLIB processor is a stand-alone package responsible for the conversion of MMS Alphanumeric Symbol tapes and GE Point Symbol tapes to disc-formatted data tapes to be used by the CDP/ECC on-line package.

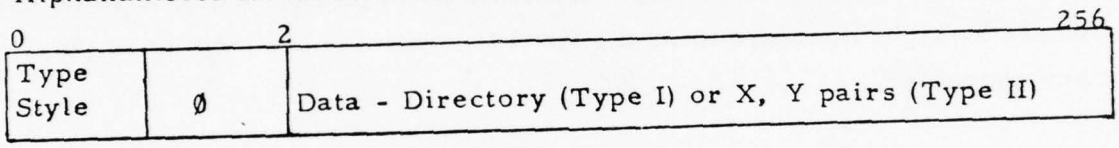
SYMLIB is the executive routine for the symbol library processor. SYMLIB, though a conversion mode with the operator on the teletype, determines the parameters for a particular job; namely, type and style of input symbols and whether the output magnetic tape is to be updated or a new symbol library generated.

The Point Symbol magnetic tape is read once to build and output the point symbol records or alphanumeric records (see Figure VI-10).

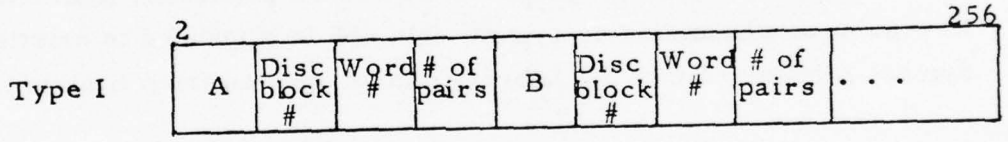
Point Symbol Record Format



Alphanumeric Record Format



Directory (1st Record of Each Type Style)



X, Y Pairs Describing Character Locii for a Given Type Style

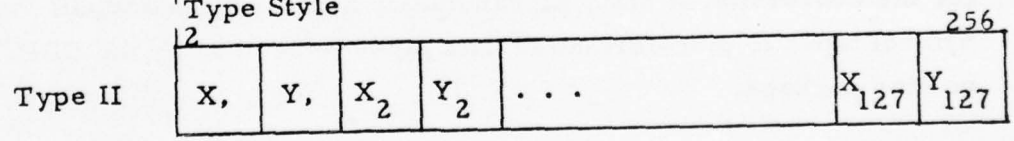


Figure VI-10 - Symbol Data Formats

6.3.2 SYMLIB Processor Set-Up Procedure

(1) Load the PDP-9 with System Monitor DOS-15. The computer will respond with:

DOS-15 V7A

$

(2) Assign handler DTA0 to device slot -14 by typing:

$A_{\Delta}DTA0_{\Delta}-14$

(3) Mount *DECtape (KIRK1) containing* LSYMLB BIN *on* Dectape transport unit No. 8.

(4) Mount the input symbol data tape (Point Symbol or MMS Alphanumeric) on magnetic transport unit No. 1 and the output Symbol Library tape on magnetic transport unit No. 2.

(5) Load core memory and QAREA with SYMLIB BIN by typing:

$G_{\Delta}SYMLIB_{\Delta}BIN$

(6) When the DECtape on unit No. 8 halts, type CONTROL S (↑S) to start the processor.

The processor is now started and parameters are requested *in a conversational mode.* See Figure VI-11 for example. The SYMLIB processor will process data on input tape and produce an output tape on *unit No. 2.*

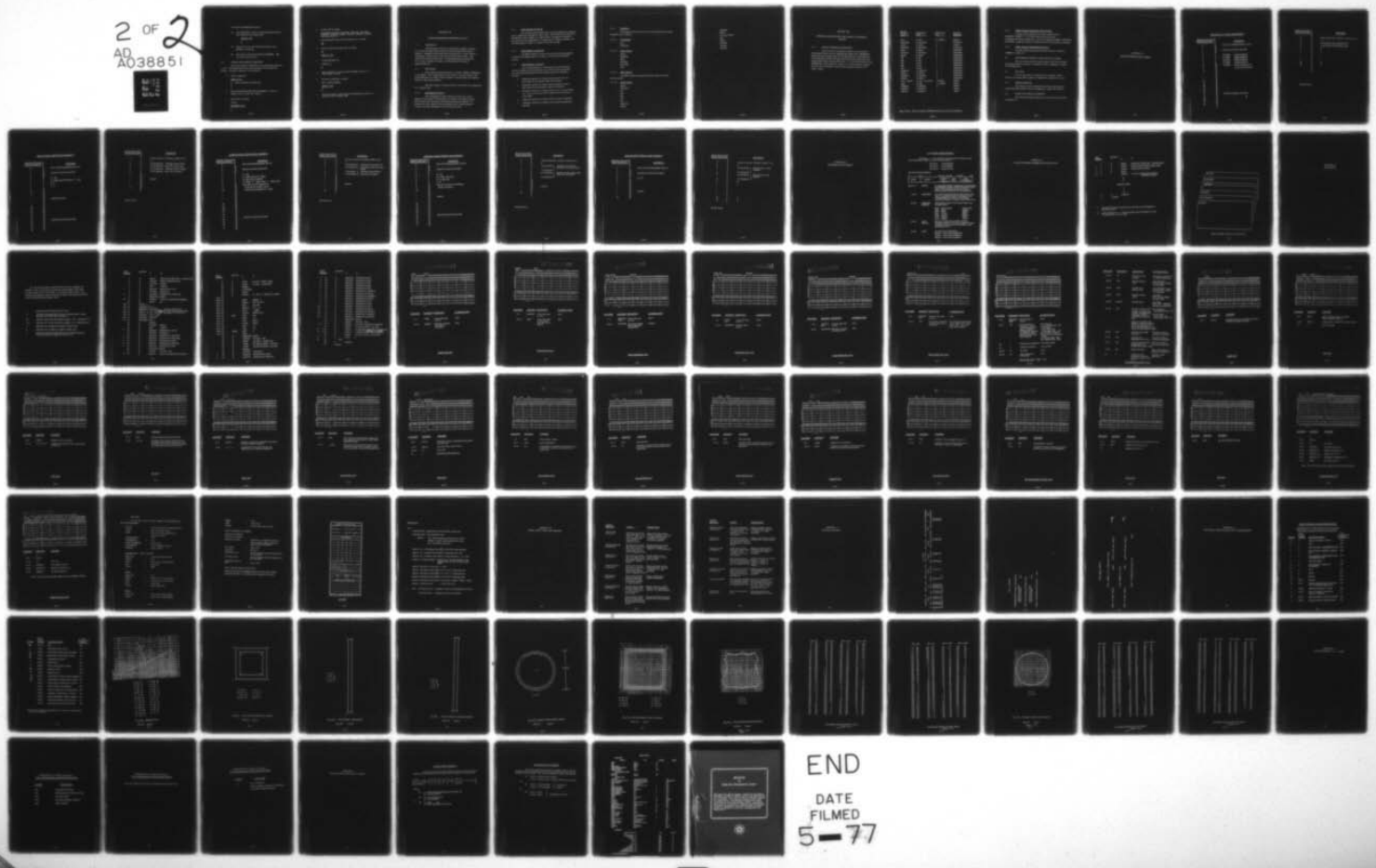
```
DOS-15 V1A

$A DTA0 -14
                    /ASSIGN DEVICE HANDLER
$G LSYMLB BIN
                    /LOAD SYMLIB PROCESSOR
↑S
                    /START PROGRAM
OUTPUT MTAPE EMPTY - TYPE 0 FOR YES, 1 FOR NO
0                   /NEW SYMBOL LIBRARY
TYPE 0 FOR POINT SYMBOL, 1 FOR ALPHANUMERIC
1                   /ALPHANUMERIC
TYPE STYLE, 00 TO 99
03                  /STYLE IDENTIFICATION CODE
TOTAL NO. OF SYMBOLS ACCEPTED FROM MAGTAPE   41
TYPE 0 FOR EOJ, 1 FOR ANOTHER MTAPE INPUT
1                   /ANOTHER INPUT TAPE
TYPE 0 FOR POINT SYMBOL, 1 FOR ALPHANUMERIC
0                   /POINT SYMBOL
TOTAL NO. OF SYMBOLS ACCEPTED FROM MAGTAPE  20
TYPE 0 FOR EOJ, 1 FOR ANOTHER MTAPE INPUT
0
STOP 000000
```

Note: Computer responses are underlined

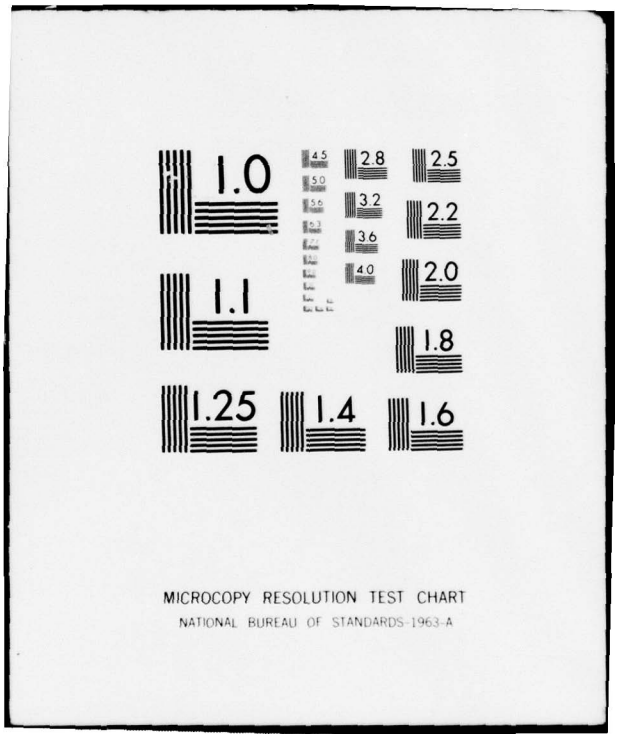
Figure VI-11 - SYMLIB Listing Example

AD-A038 851 PRC INFORMATION SCIENCES CO MCLEAN VA F/G 9/2
RASTER IMAGING SOFTWARE. USER'S GUIDE.(U)
MAR 77 R K LUBBES, P A MACERA, K S PRZEWLOCKI F30602-74-C-0345
UNCLASSIFIED RADC-TR-76-340-VOL-2 NL

2 OF 2
AD A038851



END
DATE FILMED
5-77


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

To restart the SYMLIB processor:

(1) Type CONTROL C (↑C) to reload the System M
The computer will respond with:

DOS-15 Vxx

$

(2) Reload core area with SYMLIB processor fro
↑QAREA by typing G↵

(3) Wait about 8 seconds and then hit CONTROL
to restart the processor.

6.4 SYMLIB LOAD MODULE CREATION

The load module for SYMLIB must be built under D
5.1.4). The following describes the procedures for building th
module. Computer responses are underlined.

a. Make assignments

DOS-15 V1A

$ A␣DT0␣-4/MTF1␣7/MTF2␣10/↵

$

b. Mount SYMLIB SRC/BIN DECtape (KIRK1) on unit n
(logical unit 0), write lock, remote

c. Call loader by typing:

LOAD↵

BLOADER V12A

>

d. Create load by typing:

P←SYMLIB, BARIER, RMTAPE, WMTAPE, WRTEOF, REWIND, EXTRCT, RDBUF, INTERR, GEPDP9, DISCTR
ALT (Alt mode key)

Each subroutine name will be printed as it is loaded

↑Q

e. Store on Q-area of system disc by typing:

↑Q

DOS-15 V1A

f. Assign DECtape unit

A△DT0△-14↵

$

g. Mount DECtape to contain loaded SYMLIB on unit no. 8, write enable, remote

h. Put load on DECtape by typing:

PUT △ LSYMLB△BIN↵

DOS-15 V1A

$

i. The load module is now stored on the DECtape on unit no. 8 under the name LSYMLB BIN.

SECTION VII

SYSTEM DESCRIPTION HONEYWELL 635/45

7.1 HARDWARE

The Honeywell 635/45 is a large scale scientific computer. It is a word oriented machine using 36 bit words and 256K words of memory. Attached to the system are ten tape drives, a card reader, a card punch, three printers, and mass disk and drum storage. The system does batch processing in a multi-programming environment. For a more complete discussion, see Honeywell 635 Systems' Manual (CPB-317).

7.2 SOFTWARE

The Format Conversion System is coded in COBOL, FORTRAN Y and GMAP. The responsibility of this system is the conversion of the lineal MMS data to a raster format capable of driving either the Graphics Plotter or the Scanner/Plotter.

The total system is composed of four activities each responsible for a specific task.

7.2.1 ACS Module Activity I

The ACS Module (1) edits lineal data cards for correct sequence and context of information, (2) creates a file which contains all the input data required for the Format Conversion Software, (3) produces an error report on the lineal data cards, and (4) produces a report from the information on the lineal data cards.

7.2.2 LFEC Module Activity II

The Lineal Feature Extract and Conversion Module (1) extracts from the MMS (see Appendix A) input tape, those features the user has specified for raster output, (2) converts their coordinates to Standard Locus Format (see Appendix B), (3) separates the output by feature, and (4) if the feature is areal, it creates double line casings.

7.2.3 SORT Module Activity III

The SORT Module (1) sorts the records in the file outputted by LFEC in ascending order by x within y, and (2) deletes duplicate records.

7.2.4 ARAF Module Activity IV

The Area Fill Module is responsible for (1) performing priority masking, and (2) filling the area of these features specified to be area filled/areal filled with the following options available to the user:

- filling the interior of a feature with the same color or gray shade as the exterior edge of the feature
- filling the interior of a feature with a different color or gray shade from the exterior edge of the feature
- filling the interior of a feature with no color or gray shade, i.e., so as to leave the interior blank so as to receive a donut effect
- filling the interior of a feature with a screen or hatchure
- filling the interior of a feature with a pattern specified by the user

7.2.5 Programs

The programs which make up the Format Conversion System by Module are as follows:

7.2.5.1 ACS Module

ACS
WRTCOM

7.2.5.2 LFEC Module

LFEC
REDCOM
INTL
SETTER
WRTCOM
EOF

7.2.5.3 SORT Module

The SORT Module has Squeeze Coding coded in line with the run stream.

7.2.5.4 ARAF Module

ARAF
REDCOM
SS1
SS2
SS3
SS4
SS5
CKPTTB
SFILL

SCREEN
PFILL
API thru API38
ROF
ROFG
SCNPLT
PACK16
SHFTIT

SECTION VIII

OPERATING INSTRUCTION FOR FORMAT CONVERSION SYSTEM

8.1 OBJECT PROGRAM GENERATION

All of the source programs needed to run the Format Conversion System must be compiled and output onto a PERMFILE which has been created under the ACCESS function of Time Sharing on the Honeywell 635/45 (Reference Honeywell Time Sharing System General Information Manual; BS01, Rev. 1). The size and name of the PERMFILE s which should be created to accept the object program for each source program in the Format Conversion System is in Figure VIII-1.

Source Program Name	PERMFILE Name	PERMFILE Size	Program Language
ACS	O.ACS	16 LLINKS	COBOL
WRTCOM	O.WRTCOM	1 "	FORTRAN
LFEC	O.LFEC	15 "	COBOL
REDCOM	O.REDCOM	1 "	FORTRAN
INTL	O.INTL	2 "	FORTRAN
SETTER	O.SETTER	1 "	FORTRAN
ARAF	O.ARAF	6 "	FORTRAN
SS1	O.SS1	1 "	FORTRAN
SS2	O.SS2	1 "	FORTRAN
SS3	O.SS3	1 "	FORTRAN
SS4	O.SS4	1 "	FORTRAN
SS5	O.SS5	1 "	FORTRAN
CKPTTB	O.CKPTTB	2 "	FORTRAN
SFILL	O.SFILL	2 "	FORTRAN
SCREEN	O.SCREEN	2 "	FORTRAN
PFILL	O.PFILL	2 "	FORTRAN
AP1 - AP138	O.AP1 - O.AP138	Variable	GMAP
ROF	O.ROF	2 LLINKS	GMAP
SCNPLT	O.SCNPLT	4 "	GMAP
PACK16	O.PACK16	1 "	GMAP
SHFTIT	O.SHFTIT	1 "	GMAP

Figure VIII-1 Object Programs PERMFILE Names for Source Programs

8.1.1 Object Program Generation Control Cards

Control cards to generate the object program are in Appendix C, page C-2. The same control cards are used to generate the object program for each source language COBOL, FORTRAN, and GMAP, except the control card which specifies the program's language.

8.1.2 Object Program Generation Deck Setup

The deck setup to generate the object program in shown in Appendix C, page C-3.

8.2 RUN STREAM CONTROL CARDS AND DATA CARDS

The run stream control cards and data cards for the Format Conversion System are shown in sequential order in Appendix D, pages D-2 through D-30.

8.3 RUN SLIP

The run slip which is submitted to the computer center with the run stream deck is shown in Appendix D, pages D-31 to D-34

8.4 ERROR MESSAGES

The listing of error messages found when processing the Lineal Input Data Cards is shown in Appendix E, pages E-2 and E-3.

8.5 SAMPLE STATISTICAL REPORTS

The sample statistical reports from each activity are shown in Appendix F.

APPENDIX A

MMS AND PSEUDO-MMS FORMAT

STANDARD 32 WORD MMS FORMAT*

HEADER RELATIVE WORD LOCATION	CONTENTS	
0	Zero (0) indicating header record.	
1		
2	Unused at present (zero-fill)	
3		
4	R-CODE	(right-justified)
5	F-CODE	(right-justified)
6	S-CODE	(right-justified)
7	C-CODE	(right-justified)
8	T-CODE	Up to 96 characters
9		in GE six-bit format
10		
.		
.		
.		
.		
22		
23		
24		
25		
26		
27	Unused at present (zero-fill)	
28		
29		
30		
31		

DATA RELATIVE WORD LOCATION	CONTENTS
0	Count of Data (X, Y) Pairs - in bits 11-14
1	0
2	X-Coordinate (GE floating point)
3	Y-Coordinate (GE floating point)
4	X
5	Y
.	.
.	.
.	.
.	.
.	.
30	X
31	Y

*36-Bit Words

POINT SYMBOL PSEUDO-MMS FORMAT*

HEADER RELATIVE WORD LOCATION	CONTENTS
0	Zero (0) Indicating Header Record
1	
2	Unused at present (zero-fill)
3	
4	$R = 33_8$
5	F = point symbol number ($1 - 37_8$)
6	S = 0
7	C = 0
8	
9	
10	
.	
.	Text field unused
.	
.	
.	
22	
23	
24	
25	
26	
27	Unused at present (zero-fill)
28	
29	
30	
31	

DATA RELATIVE WORD LOCATION	CONTENTS
0	Count of Data (X, Y) Pairs in Bits 11-14
1	0
2	X-Coordinate } defining symbol center
3	Y-Coordinate } (base line start point)
4	X-Coordinate } defining symbol rotation
5	Y-Coordinate } (base line end point)
6	
.	
.	Unused
.	
.	
.	
.	
31	

*36-Bit Words

ALPHANUMERIC PSEUDO-MMS FORMAT*

HEADER RELATIVE WORD LOCATION	CONTENTS
0	Zero (0) Indicating Header Record
1	Unused at present (zero-fill)
2	
3	
4	$R = 35_8$
5	F = type style (1-4, 1000_8)
6	S = type size (in points)
7	C = mode; 0 upper case, 1 lower case
8	Text field up to 96 characters in GE six bit format, end of string being indicated by a slash
9	
10	
.	
.	
.	
.	
.	
.	
22	
23	
24	Unused at present (zero-fill)
25	
26	
27	
28	
29	
30	
31	

DATA RELATIVE WORD LOCATION	CONTENTS	
0	Count of Data (X, Y) Pairs in Bits 11-14	
1	0	
2	X-Coordinate	defining string lower left
3	Y-Coordinate	coordinate (base line start point)
4	X-Coodinate	defining string rotation
5	Y-Coordinate	(base line end point)
6	Unused	
.		
.		
.		
.		
.		
.		
31		

*36 Bit Words

CONTOUR LABEL PSEUDO-MMS FORMAT*

HEADER RELATIVE WORD LOCATION	CONTENTS
0	Zero (0) Indicating Header Record
1	Unused at present (zero-fill)
2	
3	
4	R = 35
5	F = 1000, type style
6	S = 6, type size
7	C = 0
8	Text up to 6 numerics defining contour elevation
9	
10	Unused
.	
.	
.	
.	
.	
23	
24	Unused at present (zero-fill)
25	
26	
27	
28	
29	
30	
31	

DATA RELATIVE WORD LOCATION	CONTENTS	
0	Count of Data (X, Y) Pairs in Bits 11-14	
1	0	
2	X-Coordinate	defining string center left (base line start point)
3	Y-Coordinate	
4	X-Coordinate	defining string center right (base line end point)
5	Y-Coordinate	
6	Unused	
.		
.		
.		
.		
.		
.		
31		

*36 Bit Words

CLIP SEGMENT PSEUDO-MMS FORMAT*

HEADER RELATIVE WORD LOCATION	CONTENTS
0	Zero (0) Indicating Header Record
1	Unused at present (zero filled)
2	
3	
4	R = 37
5	Unused
6	
.	
.	
.	
.	
.	
.	
31	

DATA RELATIVE WORD LOCATION	CONTENTS	
0	Count of Data (X, Y) Pairs in Bits 11-14	
1	0	
2	X-Coordinate	defining start of clip segment
3	Y-Coordinate	
4	X-Coordinate	defining end of clip segment
5	Y-Coordinate	
6	X	
7	Y	
.		
.		
.		
.		
.		
.		
30	X	
31	Y	

*36 Bit Words

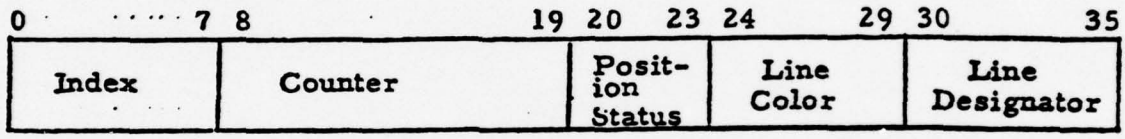
APPENDIX B
STANDARD LOCUS FORMAT

STANDARD LOCUS FORMAT

The Standard Locus Format is the format for a three word record with the contents of each word as follows:

1st Word	Y-Coordinate
2nd Word	X-Coordinate
3rd Word	Control Word

Control Word Breakdown:



Bits 0-7 INDEX — A sequential number starting at one indicating the sequence number of the Conversion Card input to the Format Conversion System which caused this feature to be extracted.

8-19 COUNTER — For each Conversion Card, the counter will equal a sequential number starting at one, representing the number of the feature extracted using this specific conversion card.

20-23 POSITION STATUS — The position status of the point before and the point after:

0000	Same before	Same after
0001	Same	Lower
0010	Same	Higher
0011	Lower	Same
0100	Lower	Higher
0101	Higher	Same
0110	Higher	Lower

24-29 LINE COLOR — Six bits of color/gray shade in either Graphics Plotter or Scanner Plotter Format depending upon which was specified in the Conversion Card

30-35 LINE — Six bits of line designator
000100 - line center designator
000001 - area start designator
000010 - area stop designator

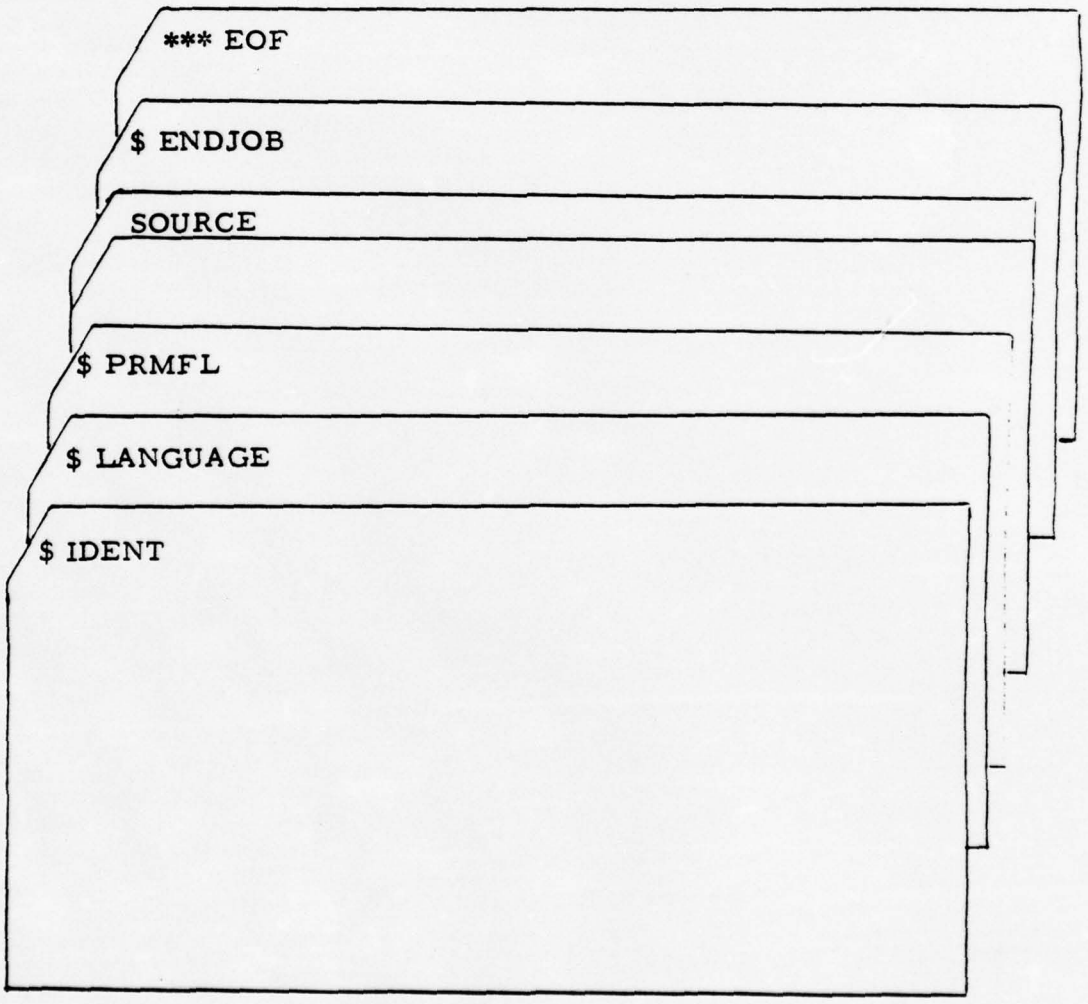
APPENDIX C

OBJECT PROGRAM GENERATION DECK SET-UP

Card Number		Columns 1	8	16
	1	$	IDENT	BICDZC03,JOHN DOE ,320303010345
*	2	$	FORTY	LSTIN,LSTOU,DECK,XREF,MAP
*	3	$	COBOL	LSTIN,LSTOU,DECK
*	4	$	GMAP	
**	5		PRMFL	C*,R/W,S,BICDZC03/OBJECT PROGRAM NAME
				↑
				SOURCE CODE
				↓
	6	$	ENDJOB	
	7	***EOF		

* Use only the control card which is the same as the language of the source code

** In the columns 34 - ?, insert the name of the Permfile to which the object code is to be output



Object Program Generation Deck Set-Up

APPENDIX D
JOB STREAM

The run stream control cards and data cards are in pages D-6 through D-30 in the order in which they should appear in the deck. All cards which have a $ in column 1 are system control cards. The contents and purpose of these cards can be found in the Honeywell 635/45 Control Cards Reference Manual; BS19.

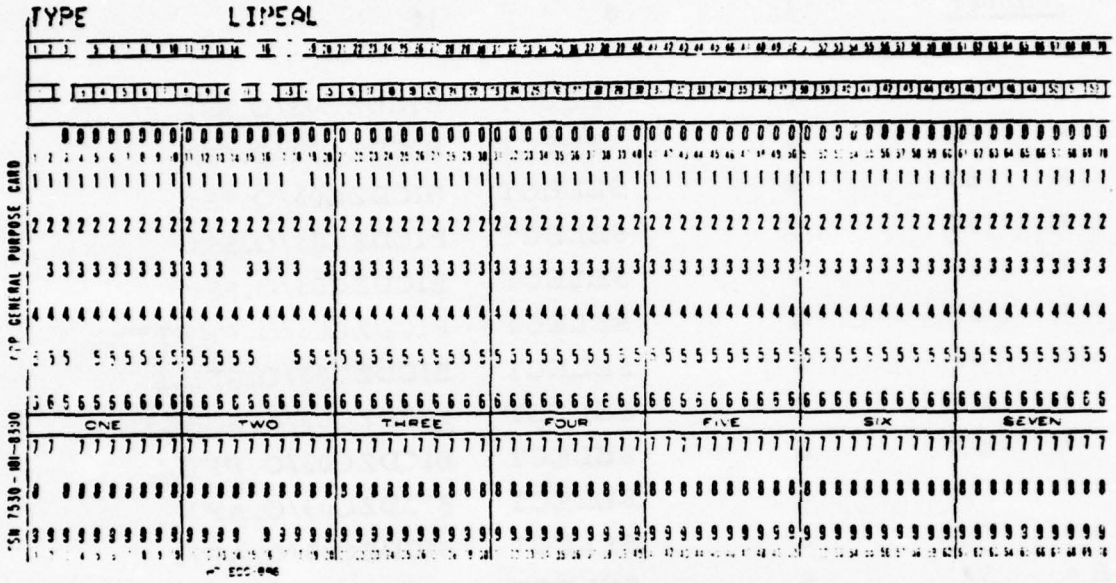
*	Indicates Object Program Select Card.
**	Indicates Permenant File Card for Common Block 1 where the name of the Permfile is optional.
***	Indicates Data Cards described on pages D-6 through D-13.
****	Indicates Sort Cards described on pages D-14 through D-28.
R	Indicates Use if output for Graphics Plotter only.
S	Indicates Use if output for Scanner Plotter only.
#	Indicates FFILE Card Specification for Graphics Scanner Plotter described on pages D-29 and D-30.

Card Number		Columns 1	8	16
	1	$	IDENT	BICDZC03,JOHN DOE ,320303010345
	2	$	USERID	BICDZC03$PASSWORD
	3	$	OPTION	COBOL
	4	$	USE	.FETSU
*	5	$	SELECT	BICDZC03/O.ACS
	6	$	OPTION	FORTRAN
*	7	$	SELECT	BICDZC03/O.WRTCOM
	8	$	EXECUTE	DUMP
**	9	$	PRMFL	10,R/W,S,BICDZC03/CMSCAN
	10	$	DATA	A4
***	11	TYPE		
***	12	SOURCE		
***	13	DESTINAT	ION	
***	14	INPUT D	EV	
***	15	OUTPUT	DEV	
***	16	OUTPUT	RES	
***	17	CONVERS	ION	
	18	$	BREAK	
	19	$	OPTION	COBOL
	20	$	USE	.FETSU
*	21	$	SELECT	BICDZC03/O.LFEC
	22	$	OPTION	FORTRAN
*	23	$	SELECT	BICDZC03/O.REDCOM
*	24	$	SELECT	BICDZC03/O.WRTCOM
*	25	$	SELECT	BICDZC03/O.INTL
*	26	$	SELECT	BICDZC03/O.SETTER
*	27	$	SELECT	BICDZC03/O.EOF
	28	$	EXECUTE	DUMP
	29	$	LIMITS	100,25K,-10K
**	30	$	PRMFL	10,R/W,S,BICDZC03/CMSCAN

These columns are variable and are described on pages D-6 thru D-13

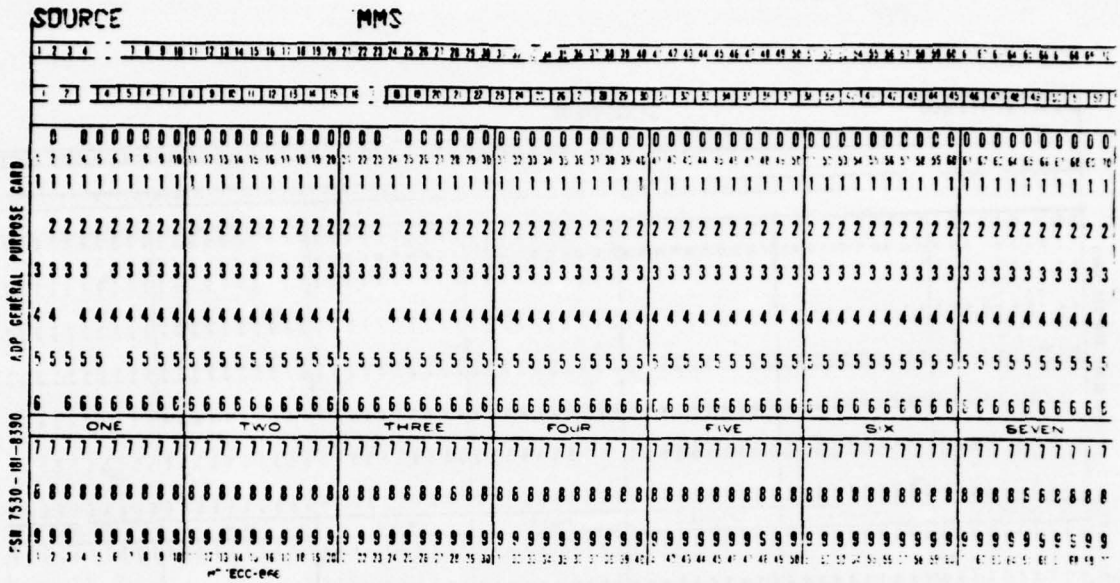
Card Number	Columns 1	8	16
31	$	TAPE	A3,X3D,,99999,,MMS
32	$	TAPE	01,X4S,,,,SCRATCH
33	$	BREAK	
34	$	LOWLOAD	
35	$	GMAP	
36	$	PRMFL	C*, RIW, S, BKDZC03/0.SORT
**** 37			
**** 38		SORT	INOUT,,3
**** 39		FIELD	(W1,W1,W1)
**** 40		SEQ	(A1,A2)
**** 41		ELECT	,T,,,,,1
**** 42		UCE	,,,SKC
**** 43		FILCB	INOUT,**,2
**** 44	SKC	LDA	2,6
**** 45		LDQ	2,7
**** 46		STQ	CNT2
**** 47		CMPA	CNT2
**** 48		TNZ	2,1
**** 49		TRA	1,1
**** 50	CNT2	OCT	0
**** 51		END	
52	$	EXECUTE	DUMP
53	$	LIMITS	100,65K,-10K
54	$	TAPE	SA,X4D,,,,SCRATCH
55	$	180PK	S1,X8D,R,99999,,,10/1000
56	$	180PK	SZ,X6S,S,99999,,,10/1000
57	$	BREAK	
58	$	OPTION	FORTRAN
* 59	$	SELECT	BICDZC03/O.ARAF
* 60	$	SELECT	BICDZC03/O.REDCOM

	Card Number	Columns 1	8	16
*	61	$	SELECT	BICDZC03/O.SS1
*	62	$	SELECT	BICDZC03/O.SS2
*	63	$	SELECT	BICDZC03/O.SS3
*	64	$	SELECT	BICDZC03/O.SS4
*	65	$	SELECT	BICDZC03/O.SS5
*	66	$	SELECT	BICDZC03/O.CKPTTB
*	67	$	SELECT	BICDZC03/O.SFILL
*	68	$	SELECT	BICDZC03/O.SCREEN
*	69	$	SELECT	BICDZC03/O.PFILL
*	70	$	SELECT	BICDZC03/O.AP3
*	71	$	SELECT	BICDZC03/O.AP13
R *	72	$	SELECT	BICDZC03/O.ROF
R *	73	$	SELECT	BICDZC03/O.ROFG
S *	74	$	SELECT	BICDZC03/O.SCNPLT
S *	75	$	SELECT	BICDZC03/O.PACK16
S *	76	$	SELECT	BICDZC03/O.SHFTIT
	77	$	EXECUTE	DUMP
	78	$	LIMITS	100,65K,-10K
**	79	$	PRMFL	10,R/W,S,BICDZC03/CMSCAN
	80	$	180PK	01,X6D,S,99999,,,10/1000
S #	81	$	FFILE	15,NLABEL,NBUFFS/2,BUFSIZ/115, FIXLNG/115,NSER
R #	82	$	FFILE	15,NSTDLB,NBUFFS/2,NDSRLS
	83	$	TAPE	15,X2D,,99999,,OUT-TAPE
S	84	$	DATA	I*
S	85	1000		
	86	$	ENDJOB	
	87	***EOF		



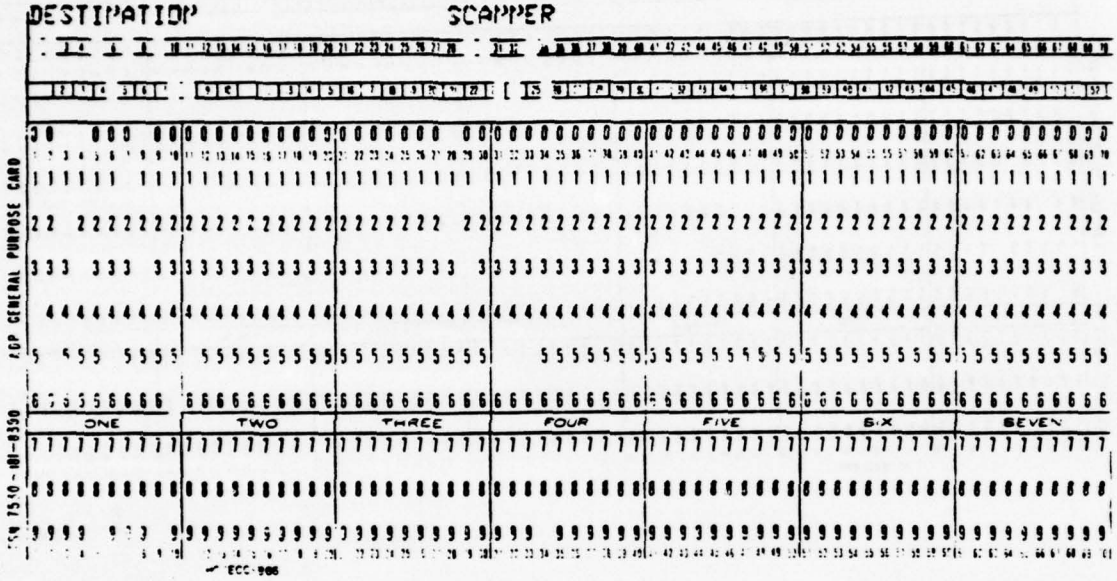
COLUMNS	CONTENT	DEFINITION	ALTERNATIVES
1-4	TYPE	Tells what type of card	None
14-19	LINEAL	Denotes to system what type of conversion	None

Lineal Type Card



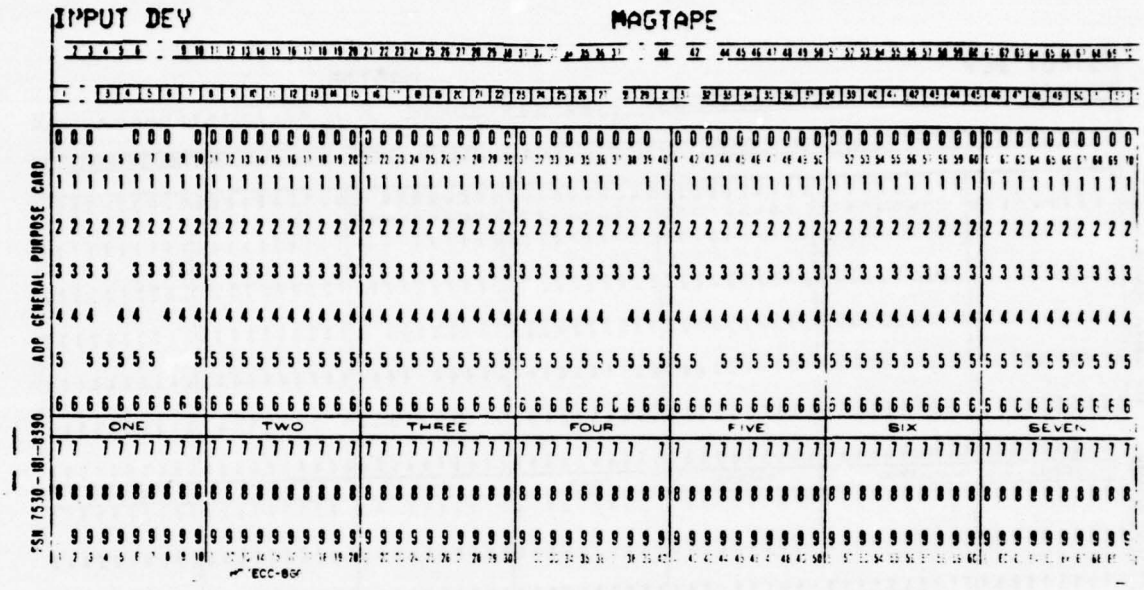
COLUMNS	CONTENT	DEFINITION	ALTERNATIVES
1-6	SOURCE	Tells what type of card	None
22-24	MMS	Tells what type of lineal input tape that will be read in	None

Lineal Source Card



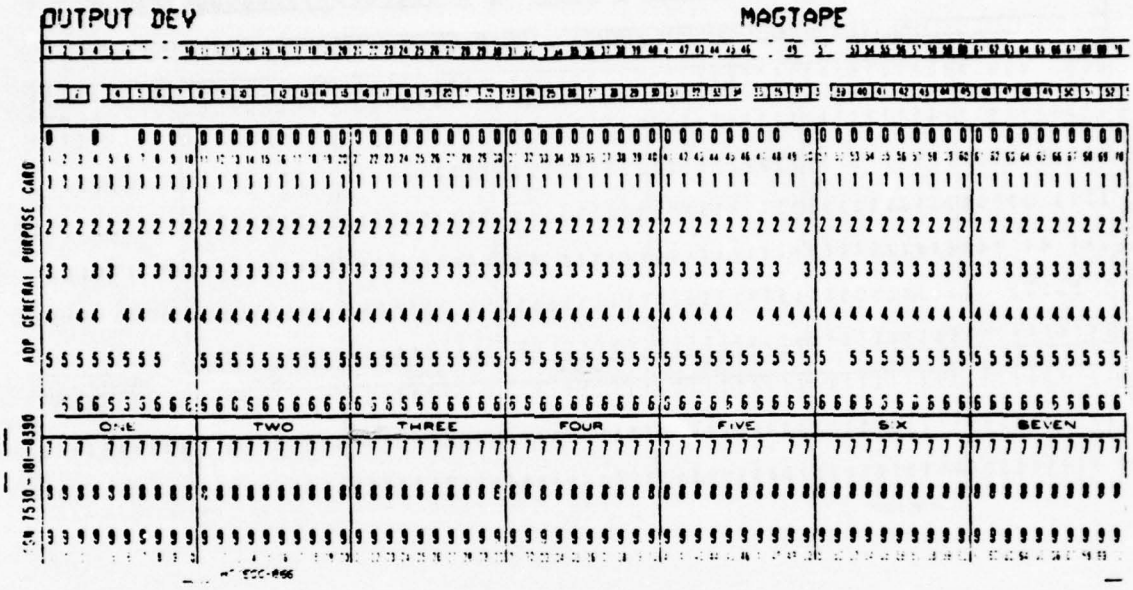
COLUMNS	CONTENT	DEFINITION	ALTERNATIVES
1-11	DESTINATION	Tells what type of card	None
28-34	SCANNER	Format for which final output tape is generated	Graphic

Lineal Destination Card



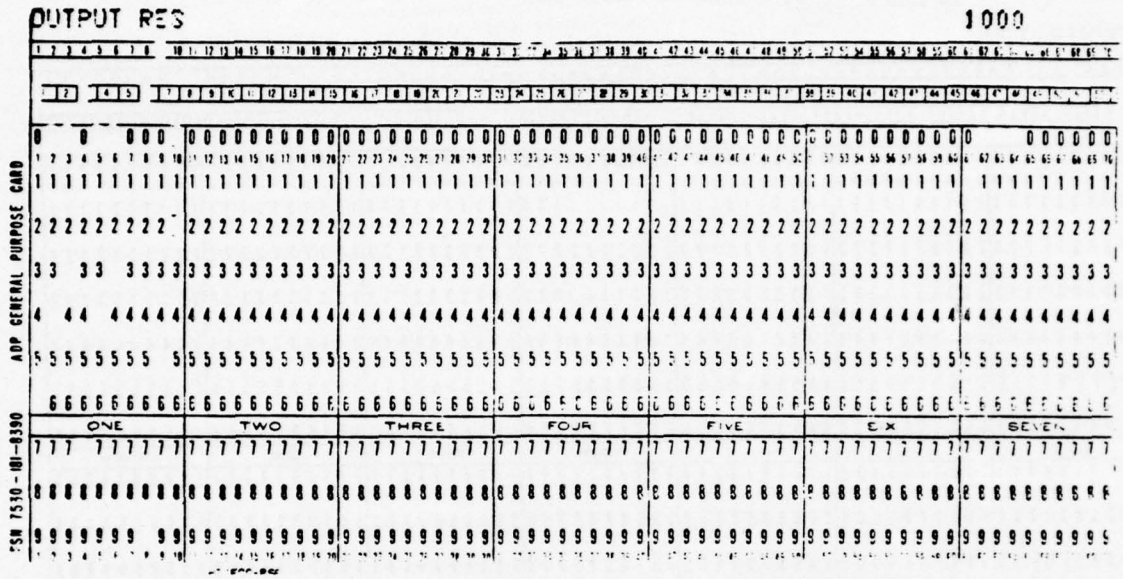
COLUMNS	CONTENT	DEFINITION	ALTERNATIVES
1-9	INPUT DEV	Tells what type of card	None
37-43	MAGTAPE	Denotes Input Device	None

Lineal Input Dev Card



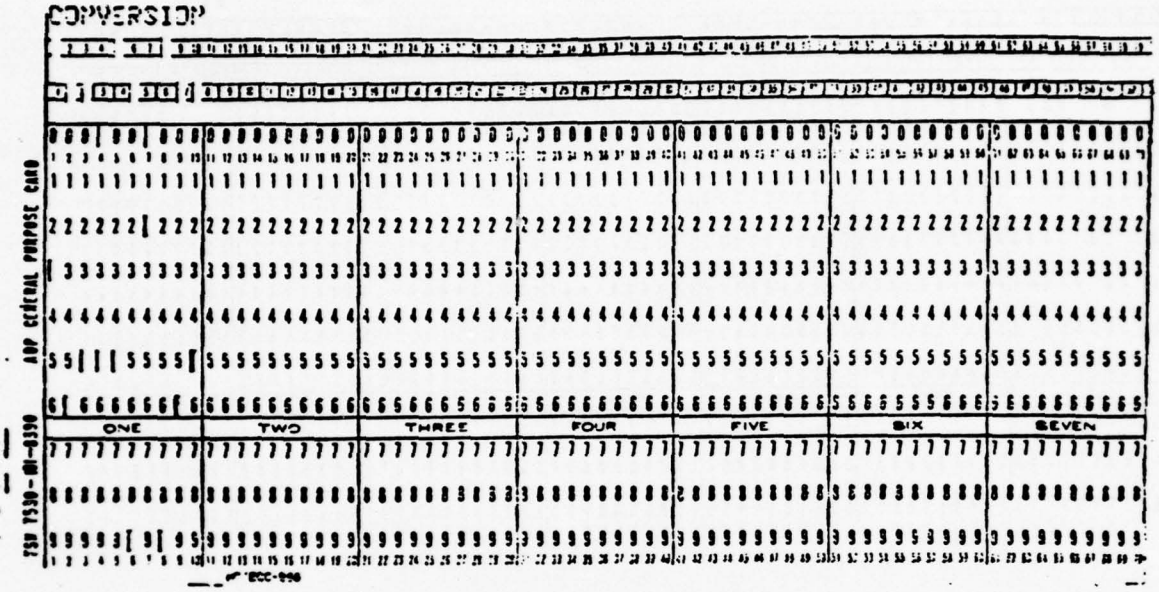
COLUMNS	CONTENT	DEFINITION	ALTERNATIVES
1-10	OUTPUT DEV	Denotes what type of card	None
46-52	MAGTAPE	Denotes to system the output device	None

Lineal Output Dev Card



COLUMNS	CONTENT	DEFINITION	ALTERNATIVES
1-10	OUTPUT RES	Denotes what type of card	None
61-64	1000	Tells what resolution the final tape will be written at	The following resolutions can be used: 0166, 0250, 0500, 0750, 1500, and 2000 right justified

Lineal Output Res Card

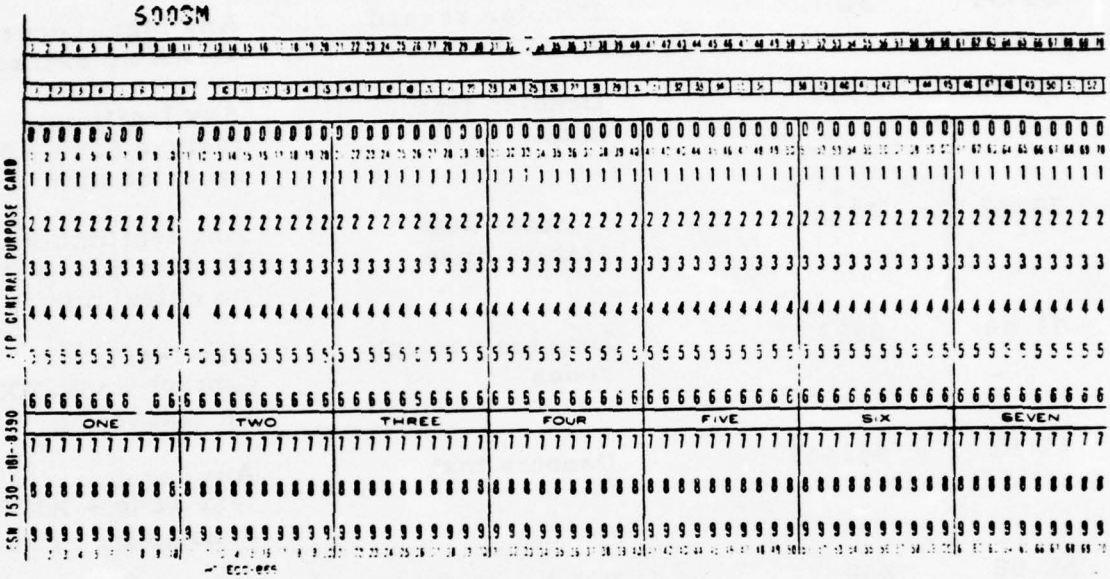


COLUMNS	CONTENT	DEFINITION	ALTERNATIVES
1-11	CONVER-SION	Denotes type of record	None
15-17	130	Denotes Fill for: a) filling a feature which encompasses another feature, b) filling the interior of a feature with a different color than the boundary	For Graphic: Any numeric 000 – 037 For Scanner: Color 000--031 Gray Shade 100 -- 131 For No Fill or Fill of Same Color as Boundary: Blank For Screen Fill: SSS For Pattern Fill: PPP
24	1	Denotes Areal Feature	0 for line center
25	1	Denotes Area Fill	0 for no fill
26-27	10	Priority	0-99
28-29	20	Line Weight for thickening	0-99

Conversion Card (Page 1 of 2)

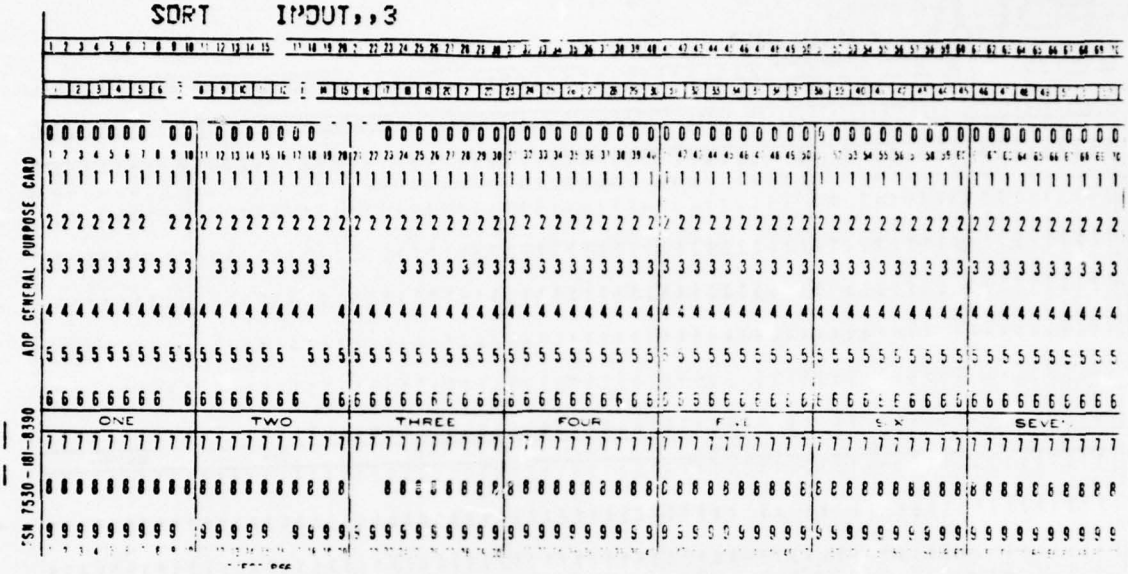
COLUMNS	CONTENTS	DEFINITION	ALTERNATIVES
33-34	34	Denotes record content	Any legal record code or XX no extraction
35-38	1111	Denotes feature code	Any legitimate feature code - XXXX no extraction
39-42	2222	Denotes sub feature code	Any legitimate sub feature code - XXXX no extraction
43-46	3333	Denotes control codes	Any legal control code-XXXX no extraction
47-52	441443	Denotes text	Any legal text code - XXXXXX denotes no extraction
56-58	030	Relates to final output Graphic: 2nd digit line weight, 3rd digit density which will be assigned to extracted file Scanner: 1st digit Gray Shade or Color distinction, 2nd & 3rd digit 00--31 the various possible breakdowns to Gray Shade & Color	For Graphics: Any numeric 000—037 For Scanner: Color 000--031 Gray Shade 100—131
62-64	020	Denotes line weight of screen	Variable; blank if screen not specified
67-69	090	Denotes line separation of screen	Variable; blank if screen not specified
72-74	045	Angle Θ formed by the perpendicular of screen lines with x-axis	090, 135; blank if screen not specified
77-79	003	Pattern Number	001--138; blank if pattern not specified
80	X	Denotes second extraction of feature for inner section cased road	Variable; blank otherwise

Conversion Card (Page 2 of 2)



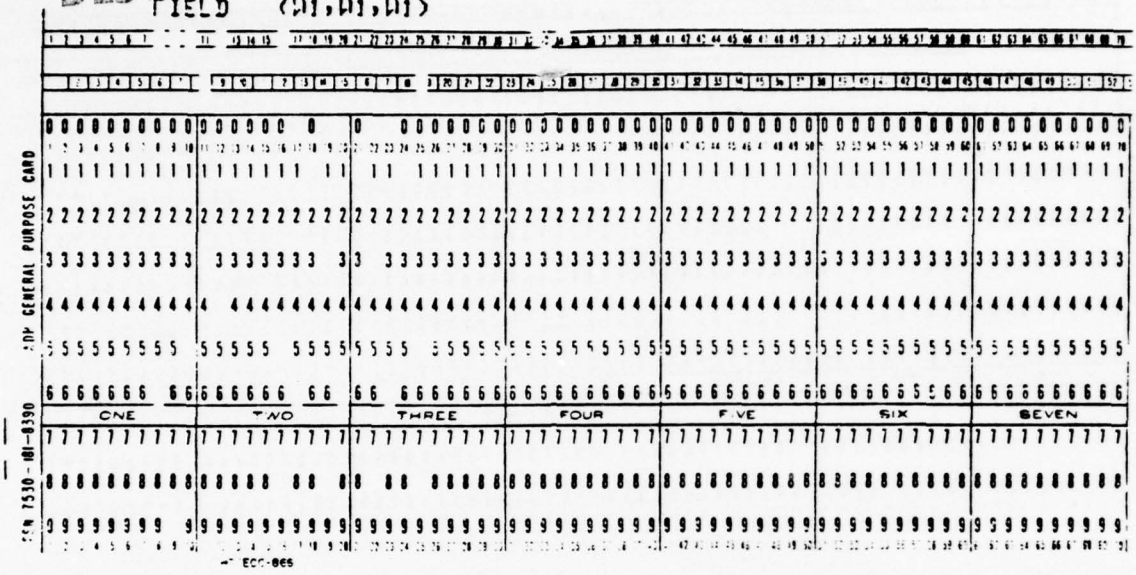
COLUMNS	CONTENT	PURPOSE
8-12	600 SM	Initialize the macro skeleton structure for SORT/MERGE Program

600SM Card



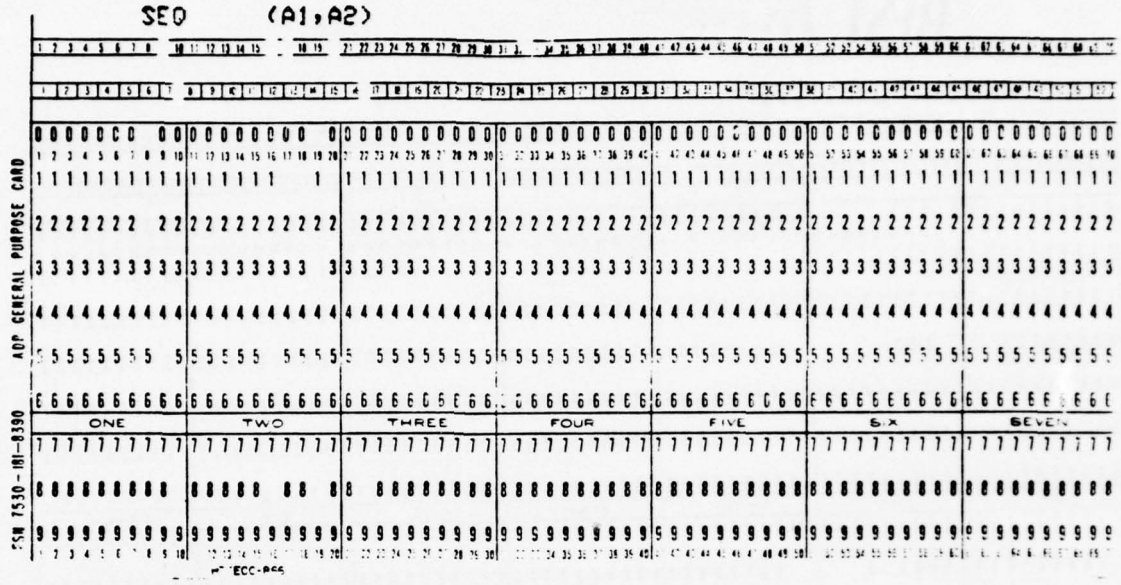
COLUMNS	CONTENT	PURPOSE
8-11	SORT	Specify Sorting Option of System SORT/MERGE Program
16-22	INOUT,,	Assign name to Input File Control Block
23	3	Record Length

Sort Card



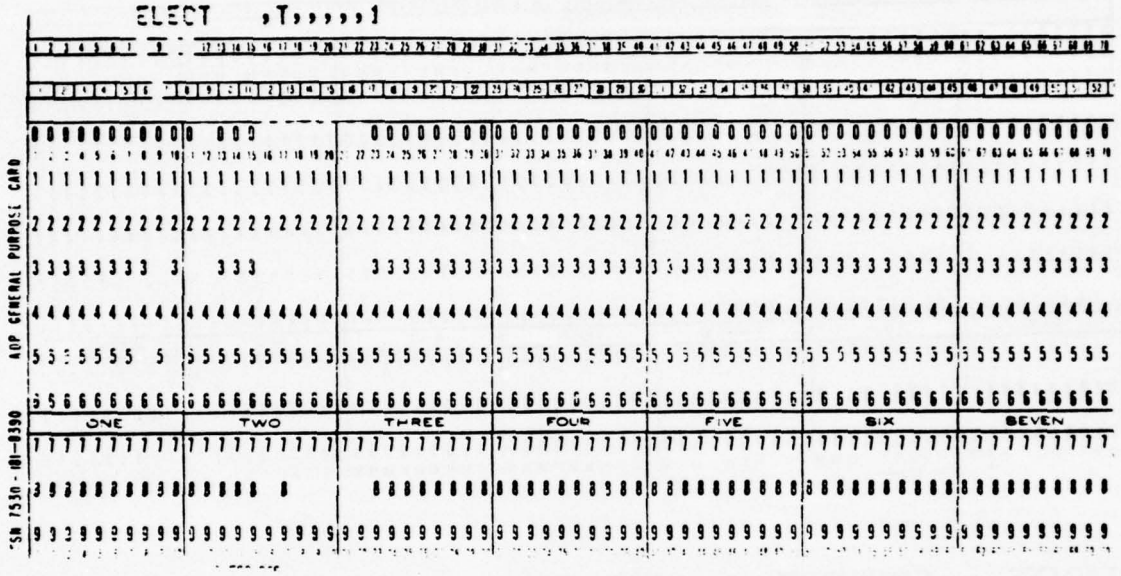
COLUMNS	CONTENT	PURPOSE
8-12	FIELD	Defines the record fields
16-25	(W1, W1, W1)	Defines three fields of one 36-bit binary word each

Field Card



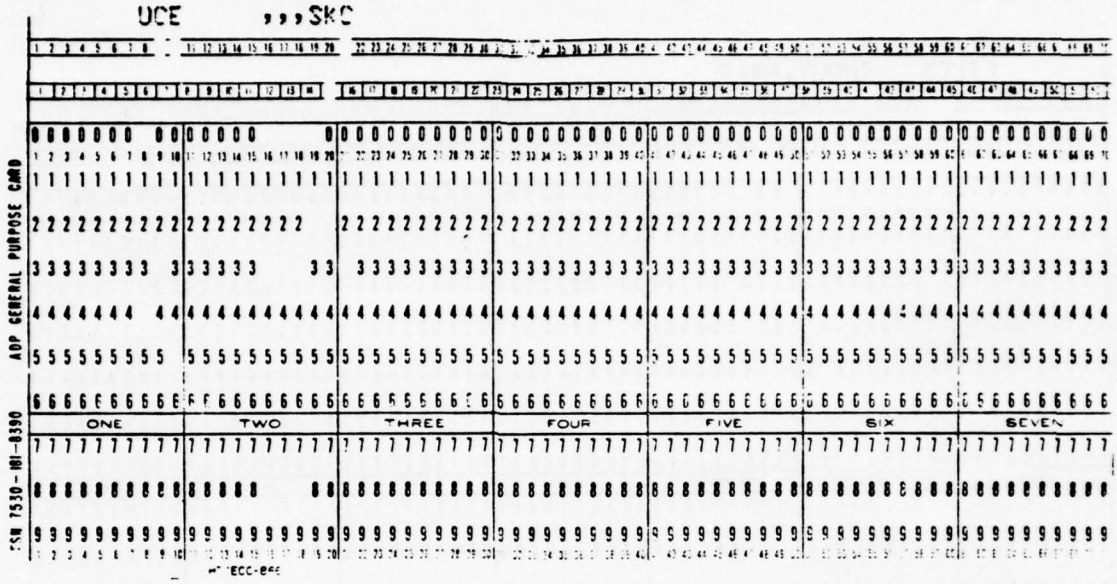
COLUMNS	CONTENT	PURPOSE
8-10	SEQ	Defines Sequencing Control Fields
16-22	(A1,A2)	Sequences the first and second word in ascending order where the major key is the first word of the record and the minor key is the second word of the record

Seq Card



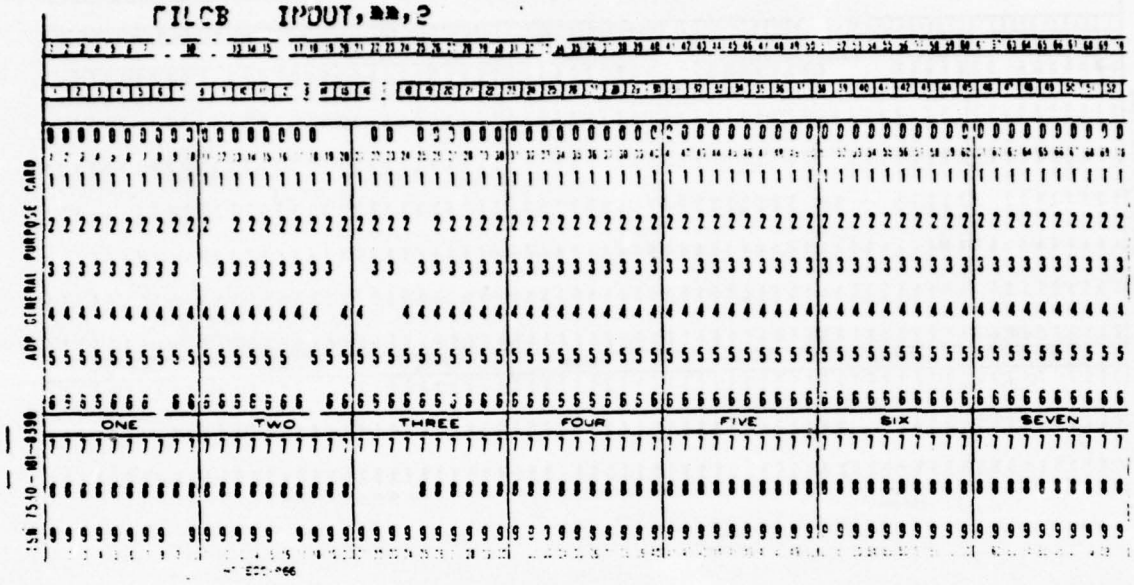
COLUMNS	CONTENT	PURPOSE
8-12	ELECT	Modify or override the Standard Functions of SORT/MERGE Program
16-23	,T,,,,,1	Journalize errors and do not use the output file as a collation working file

Elect Card



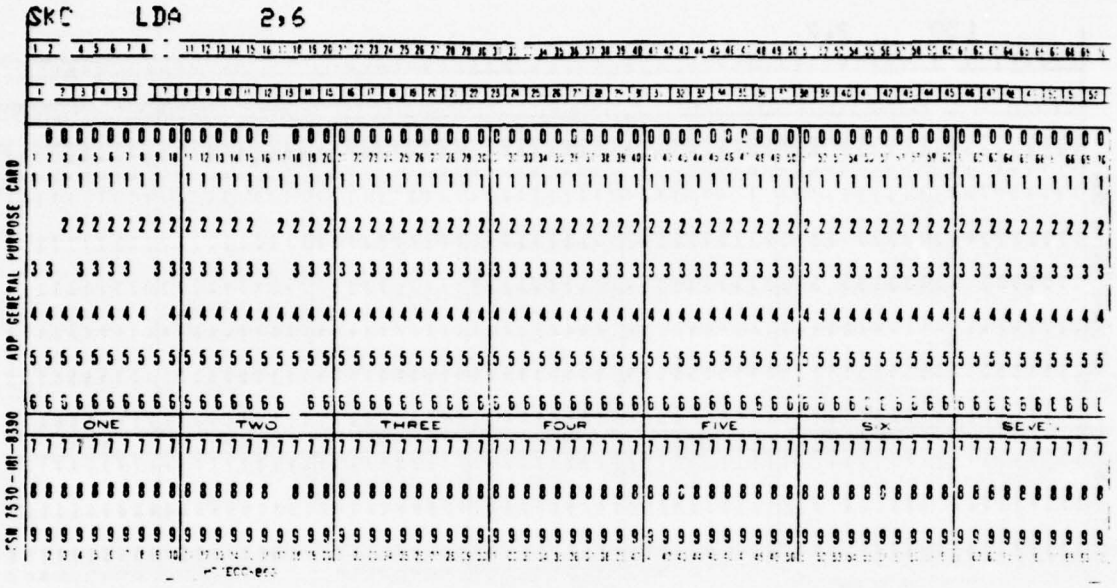
COLUMNS	CONTENT	PURPOSE
8-10	UCE	Overrides the standard input/output and key comparison procedures of the SORT/MERGE Program
16-21	,,,SKC	When used, this parameter points to the entrance coding of user squeeze coding which will delete records with equal keys

Uce Override Card



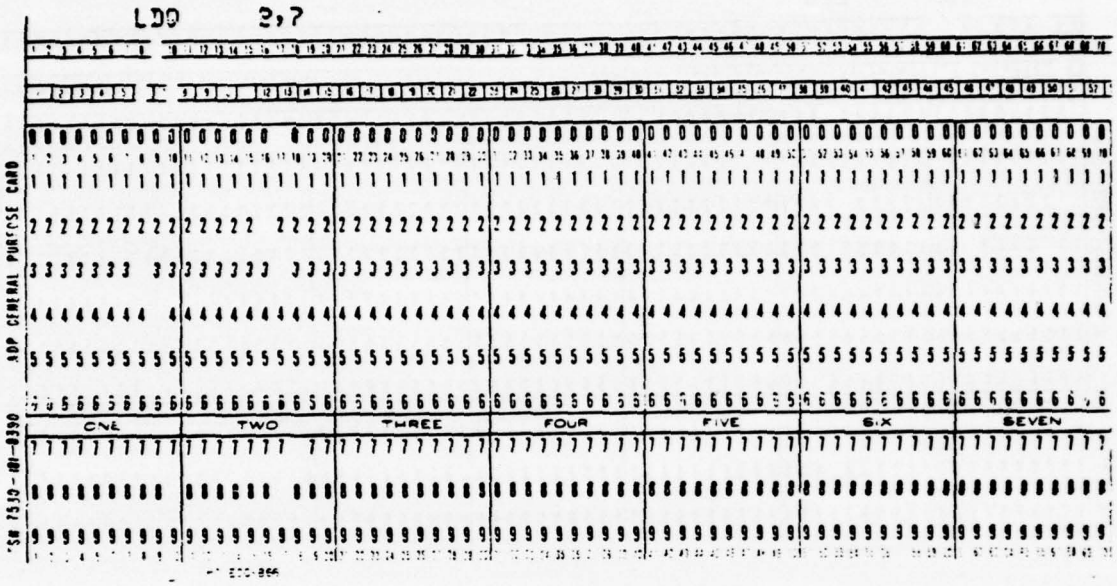
COLUMNS	CONTENT	PURPOSE
8-12	FILCB	Describes control information associated with data file
16-21	INOUT,	Locsym of file control block
22-24	**,	File code
25	2	Specifies double buffering

Filcb Card



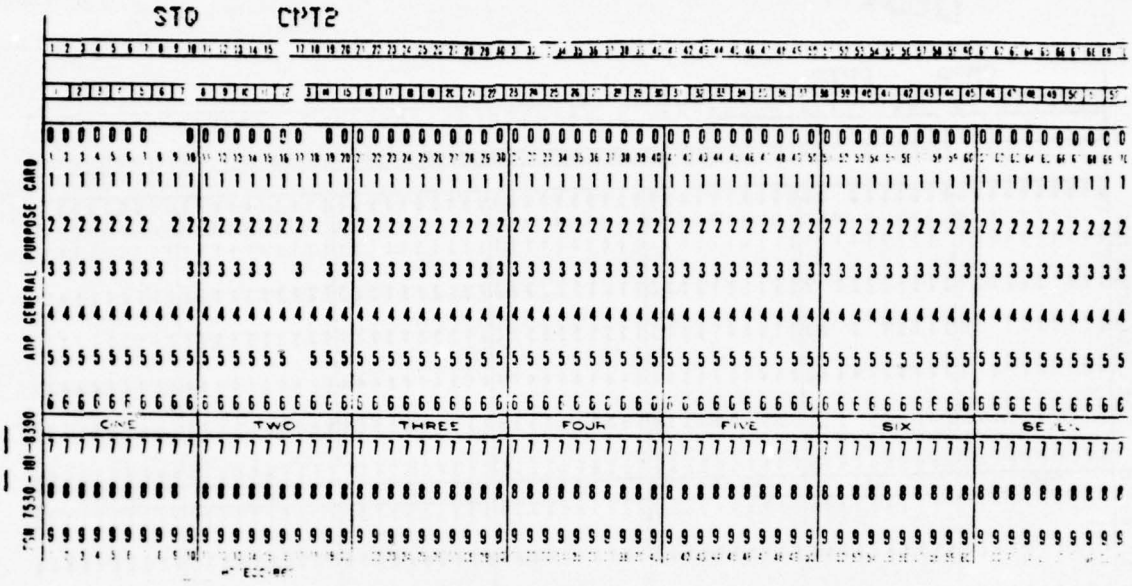
COLUMNS	CONTENT	PURPOSE
1-3	SKC	User squeeze coding
8-10	LDA	Load accumulator
16-18	2,6	Accumulator is loaded with the third word of the first record of two records with equal keys

User Squeeze Card



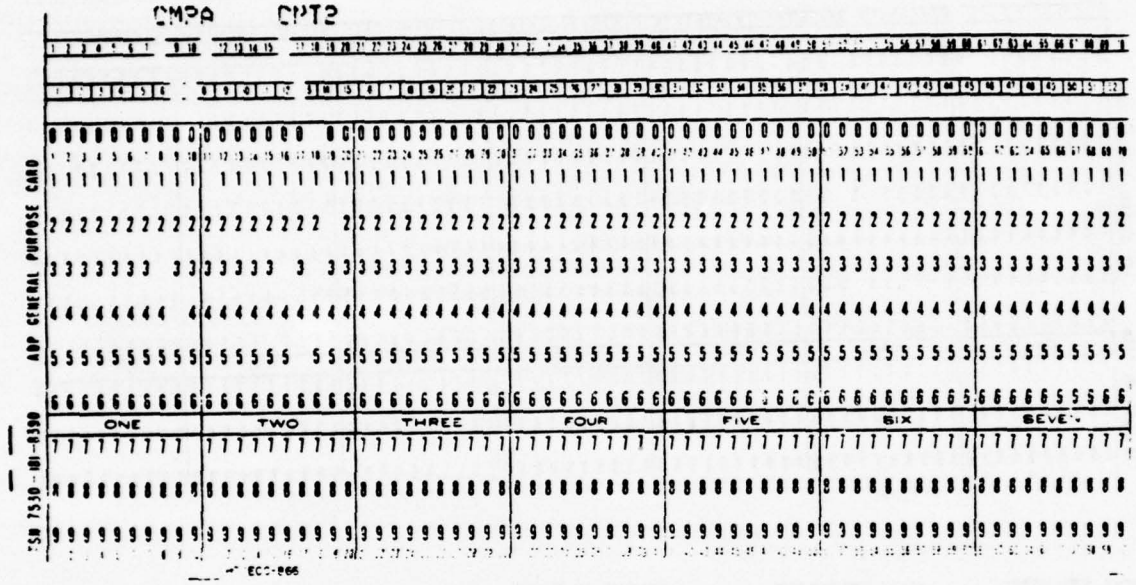
COLUMNS	CONTENT	PURPOSE
8-10	LDQ	Load quotient
16-18	2,7	Quotient is loaded with the third word of the second record of two records with equal keys

Load Quotient Card



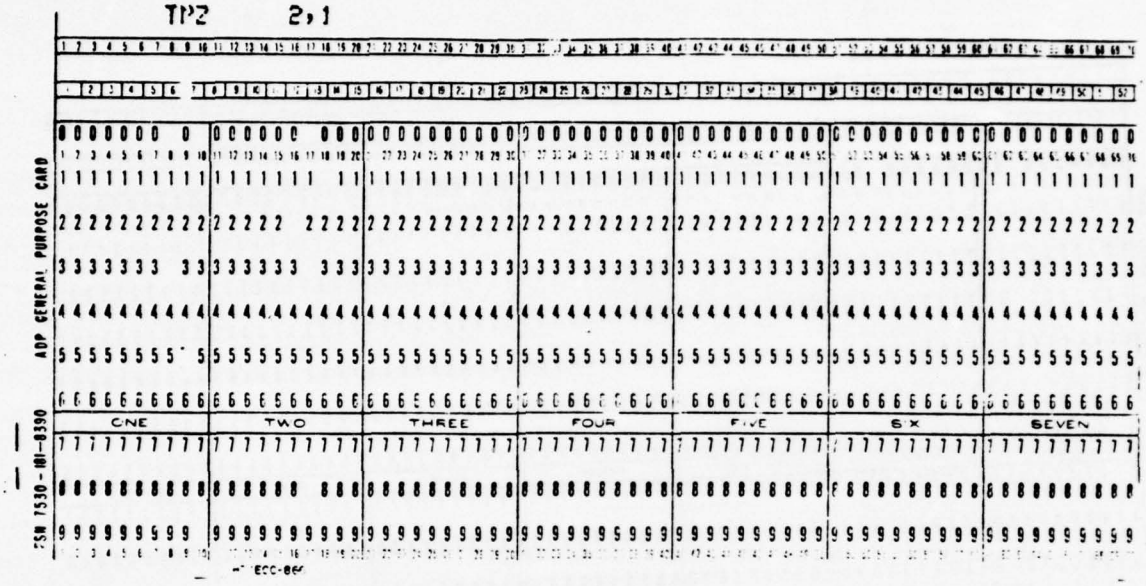
COLUMNS	CONTENT	PURPOSE
8-10	STQ	Store quotient
16-19	CNT2	Variable CNT2 contains the third word of the second record of two records with equal key

Store Quotient Card



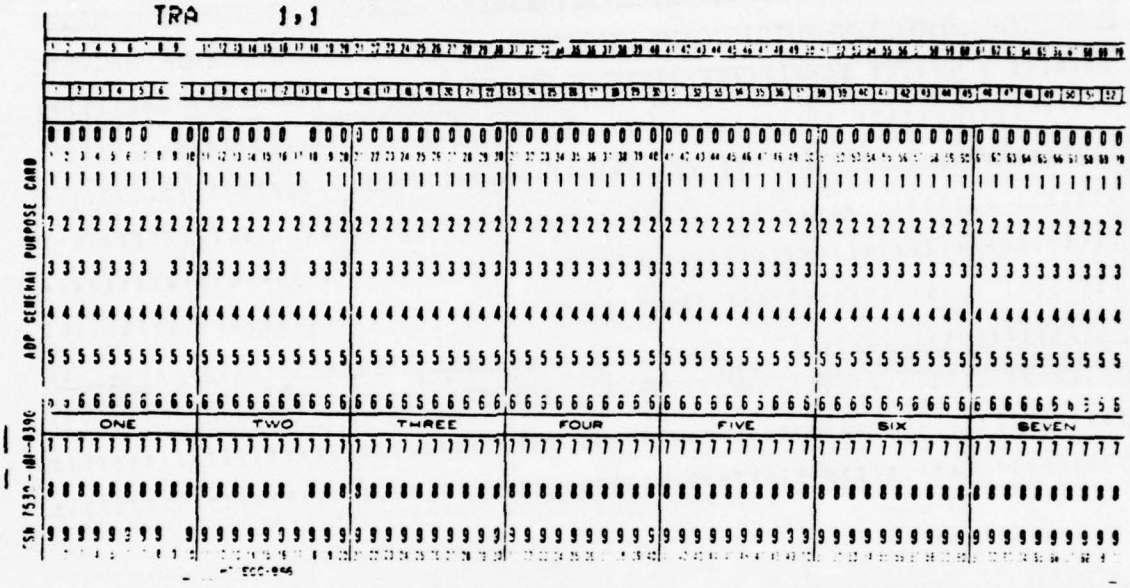
COLUMNS	CONTENT	PURPOSE
8-11	CMPA	Compare to accumulator
16-19	CNT2	Compare the contents of the third words of the two records with equal keys

Compare Card



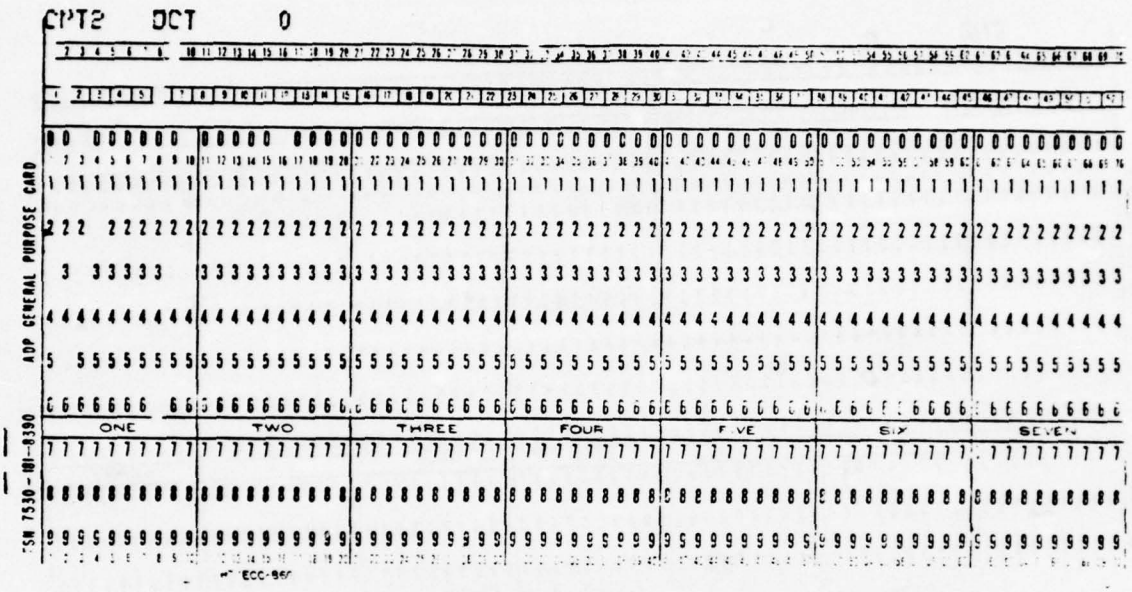
COLUMNS	CONTENT	PURPOSE
8-10	TNZ	Transfer if zero register is not on
16-18	2, 1	Transfer to return address plus two so that neither record is eliminated

Tnz Transfer Card



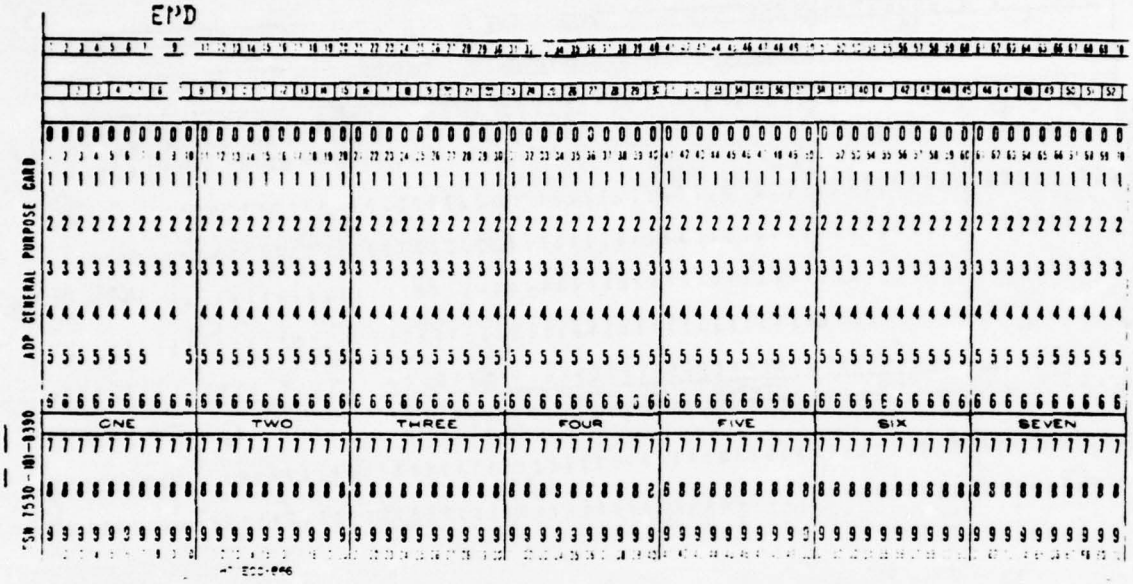
COLUMNS	CONTENT	PURPOSE
8-10	TRA	Unconditional transfer
16-18	1,1	Transfer to return location plus one so that the second record is eliminated

Tra Unconditional Transfer Card



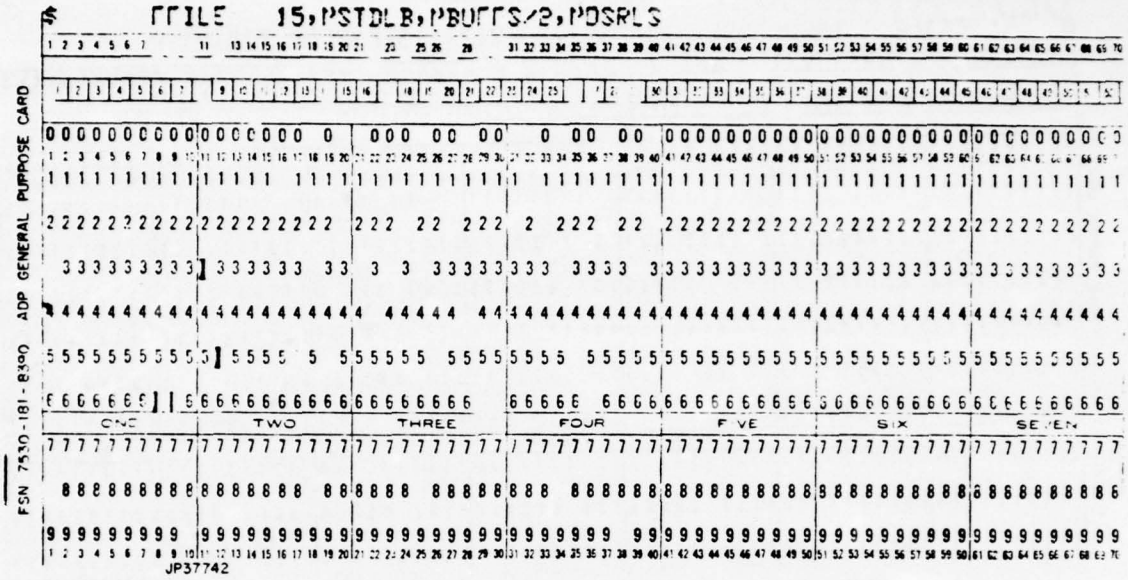
COLUMNS	CONTENT	PURPOSE
1-4	CNT2	Buffer for third word of second record
8-10	OCT	Defines 36-bit octal word
16	0	Initializes word to 0

CNT2 Card



COLUMNS	CONTENT	PURPOSE
8-10	END	End SORT/MERGE coding

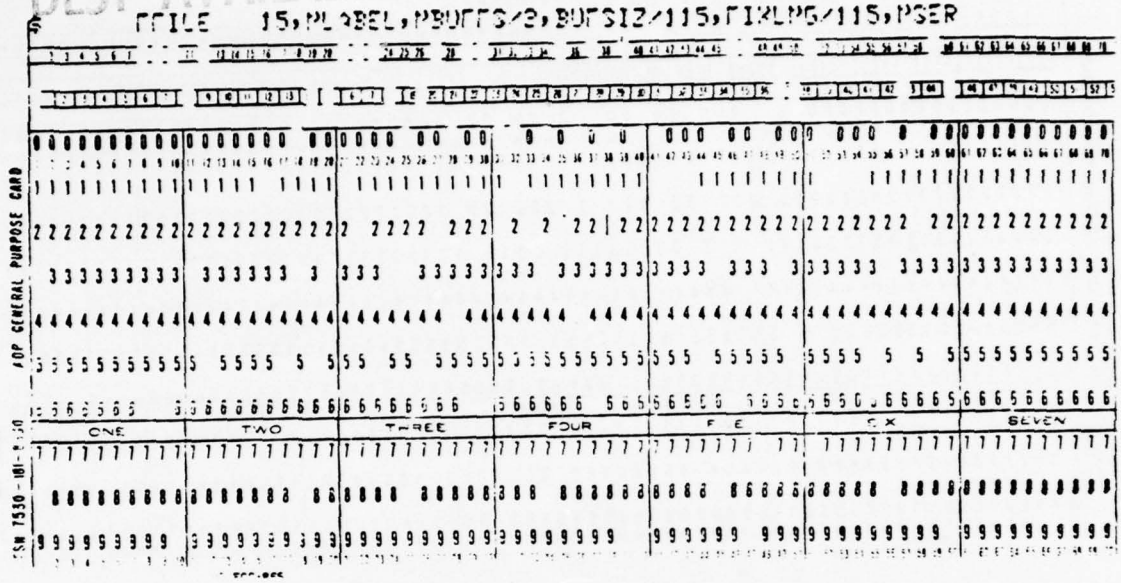
End Card



COLUMNS	CONTENT	PURPOSE
1	$	
8-12	FFILE	
16-18	15,	File code
19-25	NLABEL,	No labels specified
26-34	NBUFFS/2,	Number of buffers is 2
35-45	BUFSIZ/115,	Buffer size is 115
46-56	FIXLNG/115,	Fixlength is specified at 115
57-60	NSER	No serial number

Note: This card is used when output is for the Scanner/Plotter.

Scanner/Plotter Card



COLUMNS	CONTENT	PURPOSE
1	$	
8-12	FFILE	
16-18	15,	File code
19-25	NSTDLB,	Non standard labels
26-34	NBUFFS/2,	Number of buffers is 2
35-40	NOSRLS	No serial numbers

Note: This card is used when output is for the Graphics Plotter.

Graphics/Plotter Card

RUN SLIP

The run slip, which is shown on page D-33 is filled out in the following manner:

SNUMB	-	will be inserted by Computer Clerk
DATE	-	fill in with date of run
TIME	-	fill in with time submitted to computer facility
PROGRAMMER	-	N/A
TELEPHONE	-	N/A
RADC ENGINEER	-	users name
TELEPHONE	-	users telephone number
SYMBOL	-	users symbol

Line one under "Tapes Assigned"

REEL NO.	-	insert input tape number
WRITE	-	N/A
READ	-	insert an X in this position
DEN	-	insert 800
TITLE	-	MMS

Line 2

REEL NO.	-	N/A
WRITE	-	insert an X in this position
READ	-	insert an X in this position
DEN	-	insert 800
TITLE	-	insert SCRATCH

Line 3

REEL NO.	-	insert output tape number
WRITE	-	insert an X in this position

READ	-	N/A
DEN	-	insert 800
TITLE	-	insert output tape number

Under "Peripherals Assigned"

Mark an X in Reader

Mark an X in Printer

Mark an X in Disc	-	followed by a computer number of links necessary after links (see page D-34 for formulas)
Core Sizes	-	insert 65K
Activities	-	insert 4
Processor Time	-	insert computed time (see page D-34 for formulas)
Total Run Time	-	insert computed time (see page D-34 for formulas)
Estimated Lines of Print	-	insert 1000

Under "Special Operator Instruction"

PLEASE USE PACK NUMBERS 99999 and 99999 where 99999 equals the number of a stranger pack assigned to the user.

RADC 635 645 BATCH JOB

SNUMB NUMBER	DATE	TIME
PROGRAMMER	TELEPHONE	
RADC ENGINEER	TELEPHONE	SYMBOL

TAPES ASSIGNED

REEL NO	WRITE	READ	DEN	TITLE

PERIPHERALS ASSIGNED ☐ PRINTER ☐ PUNCH
☐ READER
☐ DISC # OF LINKS____ ☐ DRUM # OF LINKS____

CORE SIZE	ACTIVITIES
PROCESSOR TIME	ESTIMATED LINES OF PRINT
TOTAL RUN TIME	

DECKS EXPECTED

NO OF BINARY DECKS	NO OF COMDECKS

BMC		TAPE ☐ DUMP ☐ COPY	
FROM:	TO:	MODE ☐ BCD ☐ BINARY	NO OF FILES

SPECIAL OPERATOR INSTRUCTIONS

(Use reverse side if required)

RADC FORM 89 MAR 74 REPLACES RADC FORM 0-56, APR 69, WHICH WILL BE USED.

Run Slip

FORMULAS:

Let:

Total Records = Approximate Total Number of Records

Total Records = (LC+2(AREAL)) Res

Where: LC = lineal inches specified as line center
AREAL = lineal inches specified as areal
Res = resolution specified

Approx. No. of Working Links SORT = .001105 * Total Records

Approx. No. of Output Links SORT = Total Records / 320

Approx. No. of Output Links ARAF = (Total Records x 1.5) / 320

Total No. of Links Needed = Greatest No. of Links Needed of the Output Links plus the Working Links SORT

Approx. Processor Time ACS < .0010

Approx. Processor Time LREC = 4.0×10^{-7} * Total Records

Approx. Processor Time SORT = 6.0×10^{-7} * Total Records

Approx. Processor Time ARAF = 9.5×10^{-7} * Total Records

Approx. Processor Time Total = Time ACS + LFEC + SORT + ARAF

Approx. Total Run Time = Time Total x 60

* Note: Processor Time - computed in hours and thousandth of an hour

Total Run Time - computed in hours and minutes

APPENDIX E
LINEAL INPUT DATA CARD ERRORS

ERROR-MESSAGE	CAUSE	CORRECTION
"First Card Incorrect"	The first card in the lineal data deck is incorrect. This can be due to mispunched information or sequence error.	First card must contain "TYPE" punched in columns 1-11 (left justified) and "LINEAL" in columns 14-19 (left justified).
"Second Card Out of Sequence"	Second card in lineal data deck is incorrect. This can be due to mispunched information or sequence error.	Second card must contain "SOURCE" punched in columns 1-11 (left justified).
"Input Source Incorrect"	Second card in lineal data deck (Source) has the wrong information punched in columns 22-25.	Columns 22-25 must contain "MMS" or "SIT" (left justified).
"Third Card Out of Sequence"	Third card in lineal data deck is incorrect. This can be due to mispunched informations or sequence error.	Third card must contain "DESTINATION" punched in columns 1-11 (left justified).
"Destination Incorrect"	Third card in lineal data deck (Destination) has the wrong information punched in columns 28-34.	Columns 28-34 must contain "GRAPHIC".
"Fourth Card Out of Sequence"	Fourth card in lineal data deck (Input Dev) is either out of sequence or punched incorrectly.	Fourth card must contain "INPUT DEV" punched in columns 1-11 (left justified).
"Input Dev Incorrect"	Fourth card in lineal data deck (Input Dev) has the wrong information punched in columns 37-43.	Columns 37-43 must contain "MAGTAPE" (left justified).

ERROR-MESSAGE	CAUSE	CORRECTION
"Fifth Card Out of Sequence"	Fifth card in lineal data deck (Output Dev) is either out of sequence or punched incorrectly.	Fifth card must contain "OUTPUT DEV" punched in columns 1-11 (left justified).
"Incorrect Output Dev"	Fifth card in lineal data deck (Output Dev) has the wrong information punched in columns 46-52.	Columns 46-52 must contain "MAGTAPE" (left justified).
"Sixth Card Out of Sequence"	Sixth card in lineal data deck (Output Res) is either out of sequence or punched incorrectly.	Sixth card must contain "OUTPUT RES" punched in columns 1-11 (left justified).
"Incorrect Output Res"	Sixth card in lineal data deck (Output Res) has the wrong information in columns 61-64.	Columns 61-64 must contain "0166" or "0250" or "0500" or "0750" or "1000" or "1500" or "2000".
"Seventh Card Out of Sequence"	Seventh card in lineal data deck (Conversion) is either out of sequence or punched incorrectly.	Seventh card must contain "CONVERSION" punched in columns 1-11 (left justified).
"Limit Exceeded"	The user has exceeded the maximum number of extractions feature or subfeature per run.	The user is limited to 200 feature extractions and 200 subfeature extractions per run. If more data is to be processed, a new run must be set up.
"Conversion Incorrect"	Error on conversion card.	Check conversion card specifications and correct.

APPENDIX F
STATISTIC REPORTS

ACS REPORT

CONVERSION TYPE: LINEAL | SOURCE FORMAT: MMS | DESTINATION DEVICE: GRAPHIC | INPUT DEVICE: MAGTAPE | OUTPUT DEVICE: MAGTAPE | INPUT RESOLUTION: 0000 | OUTPUT RESOLUTION: 1000

RR	FFFF	SSSS	CCCC	TTTTTT	PRIORITY	LINE WIDTH	AREA	AREA-FILL	INNER COLOR DESIGNATION	OUTER COLOR DESIGNATION
34	3222	2000	0110	C03000	03	20	NO	YES	076	037
34	3222	2000	0110	C02000	02	20	NO	YES	034	037
34	3222	2000	0110	C01000	01	20	NO	YES	035	037
34	2422	1000	3110	XXXXXX	03	20	NO	YES	076	031
34	6105	0000	2332	XXXXXX	01	20	NO	NO	077	005
34	6222	1000	2112	XXXXXX	04	20	YES	YES	001	017
34	6222	1000	1221	XXXXXX	04	20	YES	NO	002	017

TIME ELAPSED (SEC) PROCESSOR ACS 0.2154

LFEC REPORT

THE MMS INPUT TAPE CONTAINED

HEADER RECORDS	7
DATA RECORDS	503

THE FLEC MODULE EXTRACTED

HEADER RECORDS	7
DATA RECORDS	503

TOTAL COORDINATES OUTPUT = 7500

ARAF MODULE REPORT

TOTAL NUMBER OF XY COORDINATE PAIRS

INPUT TO ARAF MODULE	69252	OUTPUT FROM ARAF MODULE	267800
			0

TOTAL NUMBER OF LINES

INPUT TO ARAF MODULE	8836	OUTPUT FROM ARAF MODULE	8836
			0

FIRST Y-COORDINATE OUTPUT WAS 4309

APPENDIX G
ADDITIONAL POINT SYMBOLS AND ALPHANUMERICS

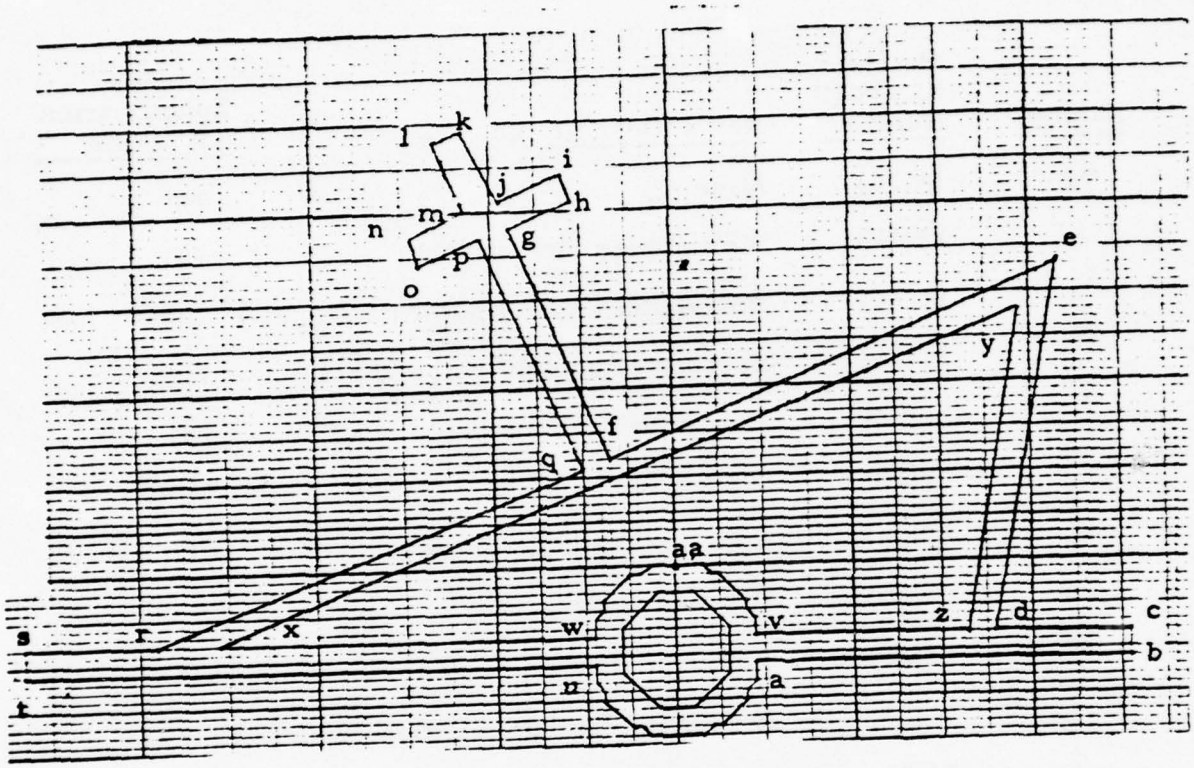
POINT SYMBOLS & ALPHANUMERICS KEY

DEFINITION OF F-CODE (Point Symbol Numbers) FOR POINT SYMBOL PSEUDO-MMS RECORD

Symbol	Point Symbol Number	Name/Description	Jog Specification Number
	1	Spring, Fountain, Cistern	344
	2	Well	345
	3	Spot elevation, unidentifiable point	407
	3	Spot elevation, highest in general area	408
	3	Spot elevation, questionable value, unidentifiable point	410
	3	Tank (all types)	732
	4	Spot elevation, highest on compilation	408
	5	Cave	447
	6	School	612
	7	Church	613
	8(10)	Mosque	613
	9(11)	Small developed areas, less than .15" at narrowest dimension	602
	10(12)	Landmark features or object	609
	11(13)	Point of change in number of tracks or of gauge	712
	12(14)	Railroad station, position unknown	713
	13(15)	Railroad station, position known	713

Symbol	Point Symbol Number	Name/Description	Jog Specification Number
	14(16)	Mine	729
	15(17)	Well (Other than water)	731
	16(20)	Horizontal control point (triangle)	750
	18(21)	*Horizontal control point (circle)	750
	18(22)	Astronomic position	751
	19(23)	Sunken rock	910
	20(24)	Rock, uncovering or awash	911
	21(25)	Exposed wreck	913
	22(26)	Sunken wreck	914
	23(27)	Anchorage for boats (small vessels)	929
	24(30)	Anchorage for ships (large vessels)	930
	25(31)	Small areas of hutments or kraals	611
	26(32)	Road location, approximate	816
	27(33)	Point of change in road information	823
	28(34)	Aqueduct, tunnel shaft, or outlet	326
	29(35)	Road interchange, pattern unknown	814
	30(36)	National (Federal) route markers	826
	31(37)	Secondary (state) route markers	827

*This symbol exists in the library but is entered automatically, never by the operator.

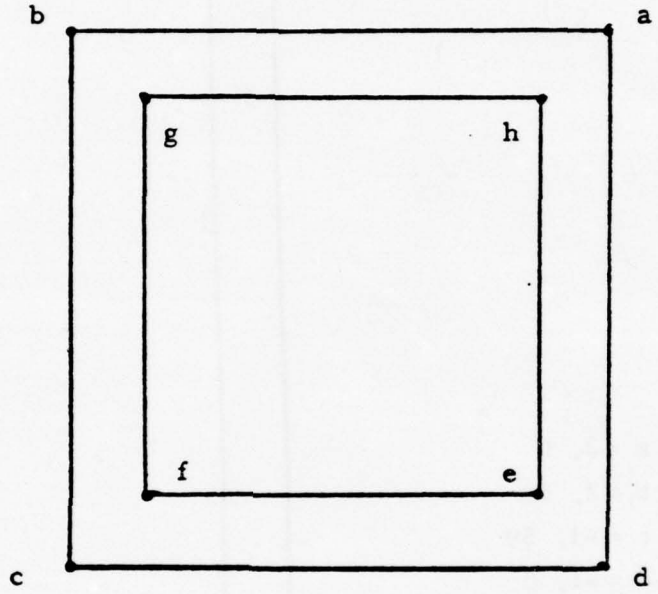


a = 9, -11	o = -28, 34
b = 51, -11	p = -21, 37
c = 51, -8	q = -10, 11
d = 36, -8	r = -58, -8
e = 43, 33	s = -73, -8
f = -7, 12	t = -73, -11
g = -18, 38	u = -9, -11
h = -11, 41	v = 9, -8
i = -12, 44	w = -9, -8
j = -19, 41	x = -51, -8
k = -23, 49	y = 39, 28
l = -26, 48	z = 33, -8
m = -23, 40	aa = 0, 0
n = -29, 37	

$21_{10}/25_{8}$ Exposed Wreck

JOG 913 Figure

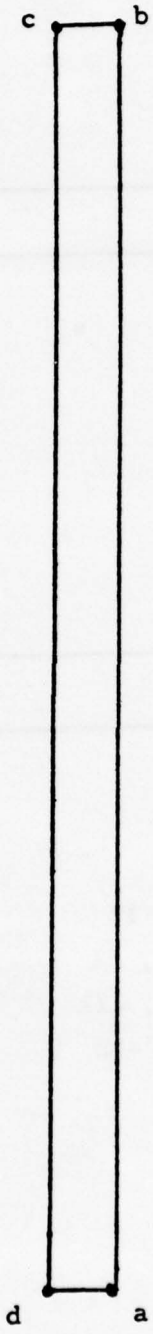
G-4



a = 12, 12	e = 9, -9
b = -12, 12	f = -9, -9
c = -12, -12	g = -9, 9
d = 12, -12	h = 9, 9

$25_{10}/31_{8}$ Small Areas of Hutments or Kraals

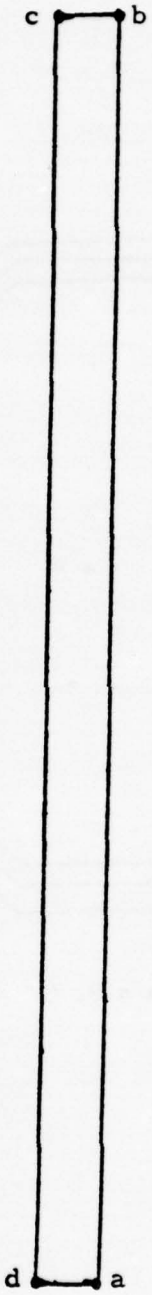
JOG 611 Figure



a = 2, 0
b = 2, 59
c = -1, 59
d = -1, 0

$26_{10}/32_{8}$ Road Location, Approximate

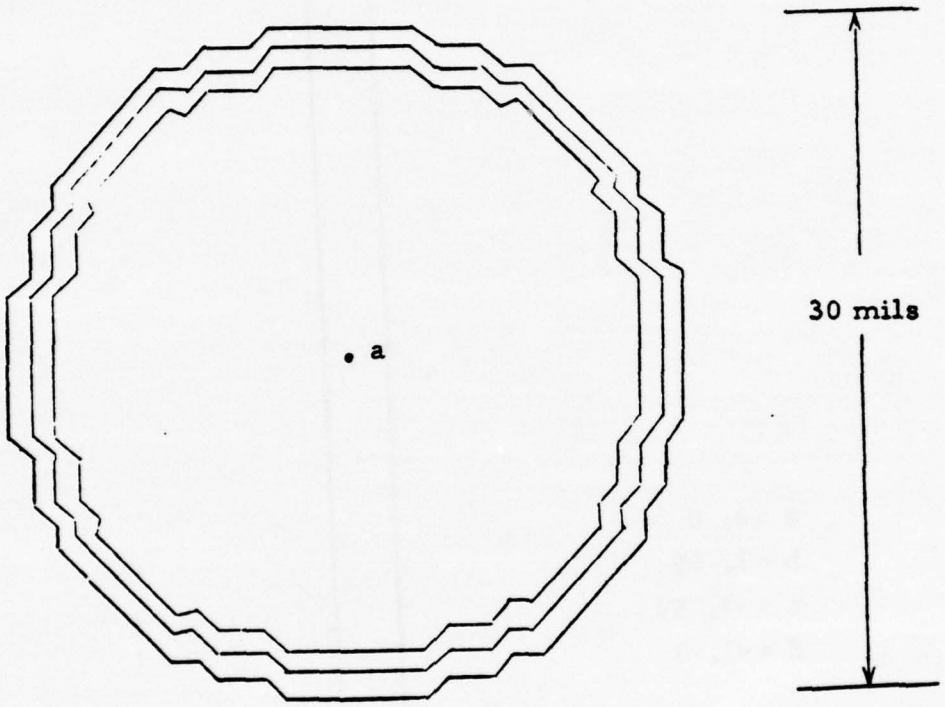
JOG 816 Figure



a = 2, 0
b = 2, 59
c = -1, 59
d = -1, 0

$27_{10}/33_{8}$ Point of Change in Road Information

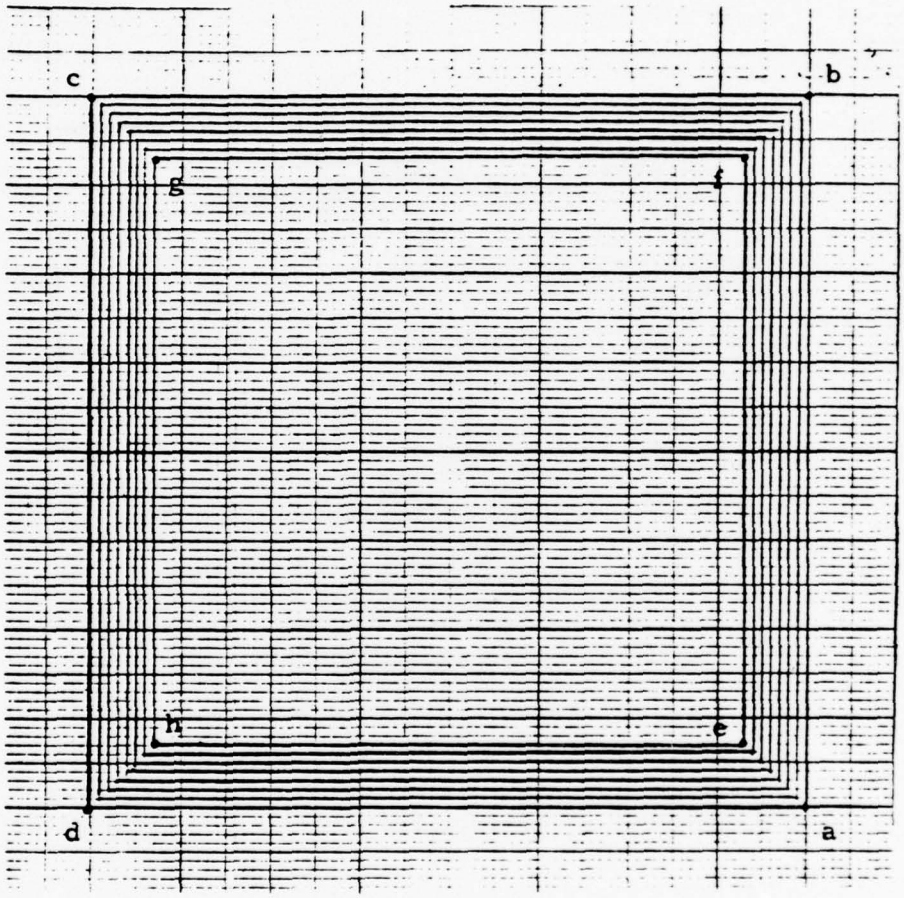
JOG 823 Figure



a = 0, 0

$28_{10}/34_{8}$ Aqueduct Tunnel Shaft or Outlet

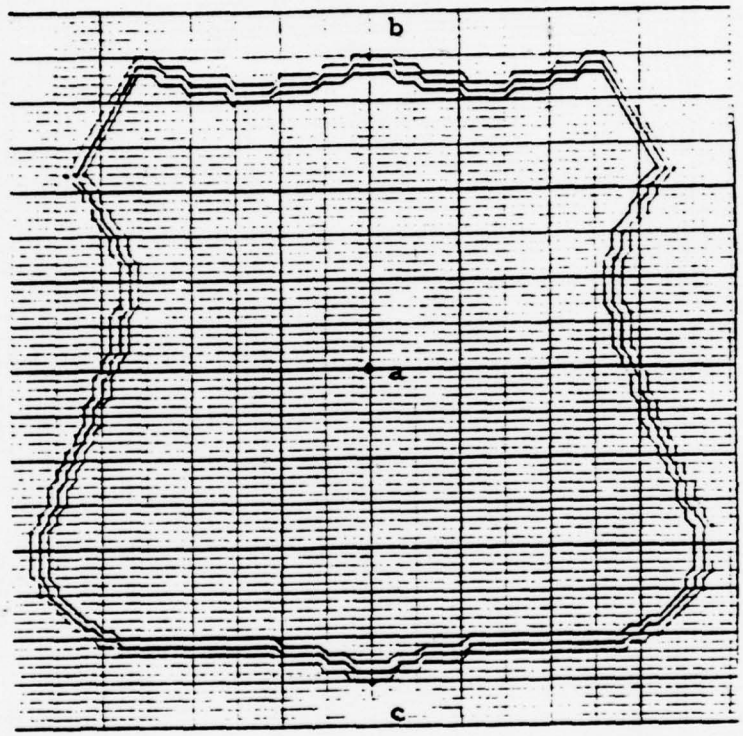
JOG 326 Figure



a = 40, -40
b = 40, 40
c = -40, 40
d = -40, -40
e = 33, -33
f = 33, 33
g = -33, 33
h = -33, -33

$29_{10}/35_{8}$ Road Interchange, Pattern Unknown

JOG 814 Figure



a = 0, 0

b = 0, 35

c = 0, -35

$30_{10}/36_{8}$ National (Federal) Route Markers

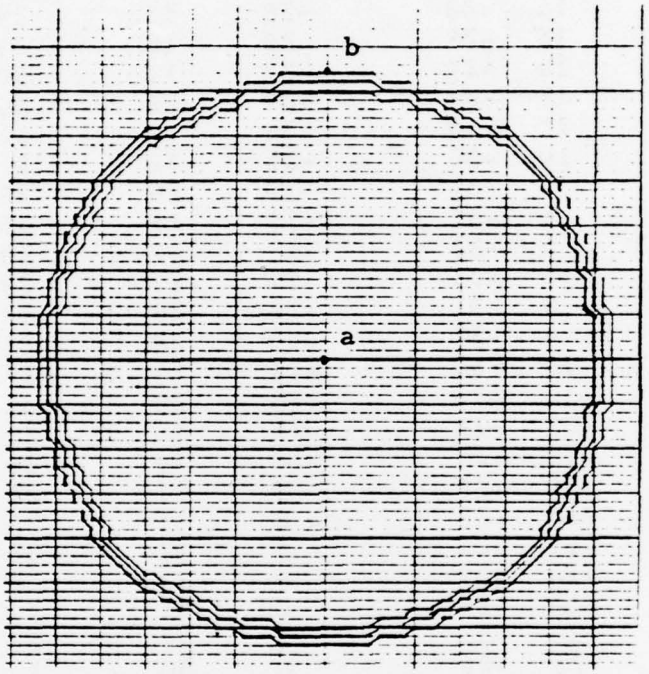
JOG 826 Figure

x	y	x	y	x	y	x	y
0	-35	34	22	-32	- 4	37	-23
2	-35	26	35	-32	- 6	37	-18
3	-34	24	35	-33	- 7	36	-17
5	-34	23	34	-33	- 8	36	-16
6	-33	21	34	-34	- 9	35	-15
10	-33	20	33	-34	-10	35	-13
11	-32	16	33	-35	-11	34	-12
28	-32	15	32	-35	-12	34	-11
29	-31	11	32	-36	-13	33	-10
30	-31	10	33	-36	-15	33	- 9
31	-30	6	33	-37	-16	32	- 8
32	-30	5	34	-37	-17	32	- 7
37	-25	3	34	-38	-18	31	- 6
37	-24	2	35	-38	-23	31	- 4
38	-23	- 2	35	-37	-24	30	- 3
38	-18	- 3	34	-37	-25	30	- 1
37	-17	- 5	34	-32	-30	29	0
37	-16	- 6	33	-31	-30	29	1
36	-15	-10	33	-30	-31	28	2
36	-13	-11	32	-29	-31	28	6
35	-12	-15	32	-28	-32	27	7
35	-11	-16	33	-11	-32	27	12
34	-10	-20	33	-10	-33	28	13
34	- 9	-21	34	- 6	-33	28	15
33	- 8	-23	34	- 5	-34	30	17
33	- 7	-24	35	- 3	-34	30	18
32	- 6	-26	35	- 2	-35	31	19
32	- 4	-34	22	0	-35	31	20
31	- 3	-32	20	0	-34	33	22
31	- 1	-32	19	2	-34	26	34
30	0	-31	18	3	-33	24	34
30	1	-31	17	5	-33	23	33
29	2	-29	15	6	-32	21	33
29	6	-29	13	10	-32	20	32
28	7	-28	12	11	-31	16	32
28	12	-28	7	28	-31	15	31
29	13	-29	6	29	-30	11	31
29	15	-29	2	30	-30	10	32
31	17	-30	1	31	-29	6	32
31	18	-30	0	32	-29	5	33
32	19	-31	- 1	36	-25	3	33
32	20	-31	- 3	36	-24	2	34

Coordinates Defining JOG 826 Figure
(Page 2 of 3)

x	y	x	y	x	y	x	y
- 2	34	-36	-24	29	- 3	-30	20
- 3	33	-36	-25	29	- 1	-29	19
- 5	33	-32	-29	28	0	-29	18
- 6	32	-31	-29	28	1	-27	17
-10	32	-30	-30	27	2	-27	15
-11	31	-29	-30	27	6	-26	13
-15	31	-28	-31	26	7	-26	12
-16	32	-11	-31	26	12	-27	7
-20	32	-10	-32	27	13	-27	6
-21	33	- 6	-32	27	15	-28	1
-23	33	- 5	-33	29	17	-28	0
-24	34	- 3	-33	29	18	-29	- 1
-26	34	- 2	-34	30	19	-29	- 3
-33	22	0	-34	30	20	-30	- 4
-31	20	0	-33	32	22	-30	- 6
-31	19	2	-33	26	33	-31	- 7
-30	18	3	-32	24	33	-31	- 8
-30	17	5	-32	23	32	-32	- 9
-28	15	6	-31	21	32	-32	-10
-28	13	10	-31	20	31	-33	-11
-27	12	11	-30	16	31	-33	-12
-27	7	28	-30	15	30	-34	-13
-28	6	29	-29	11	30	-34	-15
-28	2	30	-29	10	31	-35	-16
-29	1	31	-28	6	31	-35	-17
-29	0	32	-28	5	32	-36	-18
-30	- 1	35	-25	3	32	-36	-23
-30	- 3	35	-24	2	33	-35	-24
-31	- 4	36	-23	- 2	33	-35	-25
-31	- 6	36	-18	- 3	32	-32	-28
-32	- 7	35	-17	- 5	32	-31	-28
-32	- 8	35	-16	- 6	31	-30	-29
-33	- 9	34	-15	-10	31	-29	-29
-33	-10	34	-13	-11	30	-28	-30
-34	-11	33	-12	-15	30	-11	-30
-34	-12	33	-11	-16	31	-10	-31
-35	-13	32	-10	-20	31	- 6	-31
-35	-15	32	- 9	-21	32	- 5	-32
-36	-16	31	- 8	-23	32	- 3	-32
-36	-17	31	- 7	-24	33	- 2	-33
-37	-18	30	- 6	-26	33	0	-33
-37	-23	30	- 4	-32	22	0	-35

Coordinates Defining JOG 826 Figure
(Page 3 of 3)



a = 0, 0

b = 0, 32

$31_{10}/37_{8}$ Secondary (State) Route Markers

JOG 827 Figure

x	y
0	32
5	32
6	31
9	31
10	30
12	30
13	29
14	29
15	28
16	28
17	27
18	27
19	26
20	26
26	20
26	19
27	18
27	17
28	16
28	15
29	14
29	13
30	12
30	10
31	9
31	6
32	5
32	- 5
31	- 6
31	- 9
30	-10
30	-12
29	-13
29	-14
28	-15
28	-16
27	-17
27	-18
26	-19
26	-20
20	-26
19	-26

x	y
18	-27
17	-27
16	-28
15	-28
14	-29
13	-29
12	-30
10	-30
9	-31
6	-31
5	-32
- 5	-32
- 6	-31
- 9	-31
-10	-30
-12	-30
-13	-29
-14	-29
-15	-28
-16	-28
-17	-27
-18	-27
-19	-26
-20	-26
-26	-20
-26	-19
-27	-18
-27	-17
-28	-16
-28	-15
-29	-14
-29	-13
-30	-12
-30	-10
-31	- 9
-31	- 6
-32	- 5
-32	5
-31	6
-31	9
-30	10
-30	12

x	y
-29	13
-29	14
-28	15
-28	16
-27	17
-27	18
-26	19
-26	20
-20	26
-19	26
-18	27
-17	27
-16	28
-15	28
-14	29
-13	29
-12	30
-10	30
- 9	31
- 6	31
- 5	32
0	32
0	31
5	31
6	30
9	30
10	29
12	29
13	28
14	28
15	27
16	27
17	26
18	26
19	25
20	25
25	20
25	19
26	18
26	17
27	16
27	15

x	y
28	14
28	13
29	12
29	10
30	9
30	6
31	5
31	- 5
30	- 6
30	- 9
29	-10
29	-12
28	-13
28	-14
27	-15
27	-16
26	-17
26	-18
25	-19
25	-20
20	-25
19	-25
18	-26
17	-26
16	-27
15	-27
14	-28
13	-28
12	-29
10	-29
9	-30
6	-30
5	-31
- 5	-31
- 6	-30
- 9	-30
-10	-29
-12	-29
-13	-28
-14	-28
-15	-27
-16	-27

Coordinates Defining JOG 827 Figure
(Page 2 of 3)

x	y
-17	-26
-18	-26
-19	-25
-20	-25
-25	-20
-25	-19
-26	-18
-26	-17
-27	-16
-27	-15
-28	-14
-28	-13
-29	-12
-29	-10
-30	- 9
-30	- 6
-31	- 5
-31	5
-30	6
-30	9
-29	10
-29	12
-28	13
-28	14
-27	15
-27	16
-26	17
-26	18
-25	19
-25	20
-20	25
-19	25
-18	26
-17	26
-16	27
-15	27
-14	28
-13	28
-12	29
-10	29
- 9	30
- 6	30

x	y
- 5	31
0	31
0	30
5	30
6	29
9	29
10	28
12	28
13	27
14	27
15	26
16	26
17	25
18	25
19	24
20	24
20	23
21	23
23	21
23	20
24	20
24	19
25	18
25	17
26	16
26	15
27	14
27	13
28	12
28	10
29	9
29	6
30	5
30	- 5
29	- 6
29	- 9
28	-10
28	-12
27	-13
27	-14
26	-15
26	-16

x	y
25	-17
25	-18
24	-19
24	-20
23	-20
23	-21
21	-23
20	-23
20	-24
19	-24
18	-25
17	-25
16	-26
15	-27
14	-27
13	-28
12	-28
9	-29
6	-29
5	-30
- 5	-30
- 6	-29
- 9	-29
-10	-28
-12	-28
-13	-27
-14	-27
-15	-26
-16	-26
-17	-25
-18	-25
-19	-24
-20	-24
-20	-23
-21	-23
-23	-21
-23	-20
-24	-20
-24	-19
-25	-18
-25	-17
-26	-16

x	y
-26	-15
-27	-14
-27	-13
-28	-12
-28	-10
-29	- 9
-29	- 6
-30	- 5
-30	5
-29	6
-29	9
-28	10
-28	12
-27	13
-27	14
-26	15
-26	16
-25	17
-25	18
-24	19
-24	20
-23	20
-23	21
-21	23
-20	23
-20	24
-19	24
-18	25
-17	25
-16	26
-15	26
-14	27
-13	27
-12	28
-10	28
- 9	29
- 6	29
- 5	30
0	30
0	32

Coordinates Defining JOG 827 Figure
(Page 3 of 3)

APPENDIX H
ALPHANUMERICS F, S, C, CODES

DEFINITION OF F-CODE (Type Code)
FOR ALPHANUMERIC PSEUDO-MMS RECORD

F-CODE	TYPE STYLE
0001	CLEARFACE ITALIC
0002	COPPERPLATE GOTHIC ITALIC
0003	FUTURA BOOK
0004	FUTURA MEDIUM OBLIQUE
0005	NEWS GOTHIC

DEFINITION OF S-CODE (Point Size)
FOR ALPHANUMERIC PSEUDO-MMS RECORD

Any octal number may be used to obtain the desired point size.

DEFINTION OF C-CODE (Type Mode)
FOR ALPHANUMERIC PSEUDO-MMS RECORD

C-CODE	TYPE MODE
0	ALL CAPITALS
1	FIRST SYMBOL CAPITAL FOLLOWED BY LOWER CASE SYMBOLS.

APPENDIX I
CDLOAD INPUT AND OUTPUT FORMAT

CDLOAD INPUT FORMAT

The input to the Card Load Module consists of the X, Y pairs defining the point symbols, the symbols being separated as illustrated:

COL.	1	2-5	6	7	8 - 11	12 - 80
CONTAINS	±	A	,	±	B	BLANK

Where:

(1) A = 9999 indicating beginning of symbol and
B = symbol number

(2) A = X-Coordinate and
B = Y-Coordinate

or

(3) A = 9999 and
B = 9999 indicating end of input

CDLOAD OUTPUT FORMAT

The Card Load Module outputs a magnetic tape in GE 635 standard format consisting of a series of two 36-bit word records defining the point symbols. The values contained in these records are:

(1) Word 1 = point symbol number
Word 2 = number of X, Y pairs defining this symbol

or

(2) Word 1 = X-Coordinate } defining the
Word 2 = Y-Coordinate } symbol

or

(3) Word 1 = 9999 } indicating end of file
Word 2 = 9999 }

METRIC SYSTEM

BASE UNITS:

Quantity	Unit	SI Symbol	Formula
length	metre	m	...
mass	kilogram	kg	...
time	second	s	...
electric current	ampere	A	...
thermodynamic temperature	kelvin	K	...
amount of substance	mole	mol	...
luminous intensity	candela	cd	...

SUPPLEMENTARY UNITS:

plane angle	radian	rad	...
solid angle	steradian	sr	...

DERIVED UNITS:

Acceleration	*metre per second squared*	...	m/s
activity (of a radioactive source)	disintegration per second	...	(disintegration)/s
angular acceleration	radian per second squared	...	rad/s
angular velocity	radian per second	...	rad/s
area	square metre	...	m
density	kilogram per cubic metre	...	kg/m
electric capacitance	farad	F	A·s/V
electrical conductance	siemens	S	A/V
electric field strength	volt per metre	...	V/m
electric inductance	henry	H	V·s/A
electric potential difference	volt	V	W/A
electric resistance	ohm		V/A
electromotive force	volt	V	W/A
energy	joule	J	N·m
entropy	joule per kelvin	...	J/K
force	newton	N	kg·m/s
frequency	hertz	Hz	(cycle)/s
illuminance	lux	lx	lm/m
luminance	candela per square metre	...	cd/m
luminous flux	lumen	lm	cd·sr
magnetic field strength	ampere per metre	...	A/m
magnetic flux	weber	Wb	V·s
magnetic flux density	tesla	T	Wb/m
magnetomotive force	*ampere*	A	...
power	watt	W	J/s
pressure	pascal	Pa	N/m
quantity of electricity	coulomb	C	A·s
quantity of heat	joule	J	N·m
radiant intensity	watt per steradian	...	W/sr
specific heat	joule per kilogram-kelvin	...	J/kg·K
stress	pascal	Pa	N/m
thermal conductivity	watt per metre-kelvin	...	W/m·K
velocity	metre per second	...	m/s
viscosity, dynamic	pascal-second	...	Pa·s
viscosity, kinematic	square metre per second	...	m/s
voltage	volt	V	W/A
volume	cubic metre	...	m
wavenumber	reciprocal metre	...	(wave)/m
work	joule	J	N·m

SI PREFIXES:

Multiplication Factors	Prefix	SI Symbol
1 000 000 000 000 = 10^{12}	tera	T
1 000 000 000 = 10^{9}	giga	G
1 000 000 = 10^{6}	mega	M
1 000 = 10^{3}	kilo	k
100 = 10^{2}	hecto*	h
10 = 10^{1}	deka*	da
0.1 = 10^{-1}	deci*	d
0.01 = 10^{-2}	centi*	c
0.001 = 10^{-3}	milli	m
0.000 001 = 10^{-6}	micro	μ
0.000 000 001 = 10^{-9}	nano	n
0.000 000 000 001 = 10^{-12}	pico	p
0.000 000 000 000 001 = 10^{-15}	femto	f
0.000 000 000 000 000 001 = 10^{-18}	atto	a

* To be avoided where possible

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Rome Air Development Center

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